PUBLIC WORKS

Aug. 1958

CITY, COUNTY AND STATE

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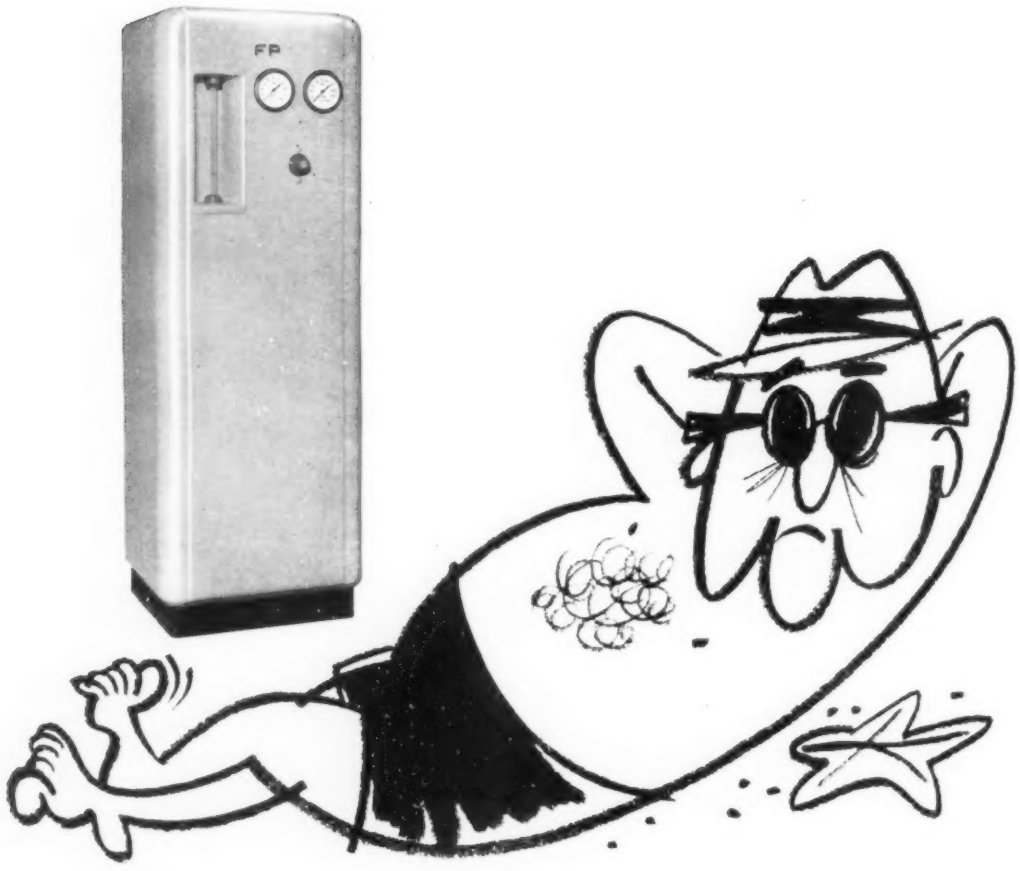
AND MANY OTHER
IMPORTANT ARTICLES
SEE PAGE 5

Edward L. Cyr is Engineer in Charge, Bureau of Traffic & Signals, Newark, N. J. Background shows some of city's new street lights and electronically controlled traffic signals. See page 18 for more data.



Technological unemployment they calls it...

It's a terrible thing to be put out of business by a machine. Used to be I was the hottest chlorinator fixer in the country. Travelled up and down the coast from job to job. And the pay was better than good.

OH! the fun I had till Fischer & Porter walked in with that new chlorinator! What with all kinds of special materials and fancy diaphragm regulators it hardly ever needed fixing at all.*

Still, I figured it would be twenty years before anybody would take a chance on such new-fangled tomfoolery. Why it didn't even *look* like a chlorinator!

Next thing I knew, those Fischer & Porter Chlorinators were springing up like so many mushrooms. And where one of them appeared, seems like *two* of the old-fashioned kind were cashiered out. Still it took five years for me to see the handwriting on the wall and retire.

• • •

Now, a word to the wise is supposed to be sufficient. If you'd rather not be dependent on chlorinator repairs, why not get the facts on new-fashioned chlorinators from Fischer & Porter Co., 588 Fischer Road, Hatboro, Pennsylvania.

FP FISCHER & PORTER CO.

Instrumentation and Chlorination

*Any wonder everyone's *trying* to copy F&P's design now?

"from Chicago"

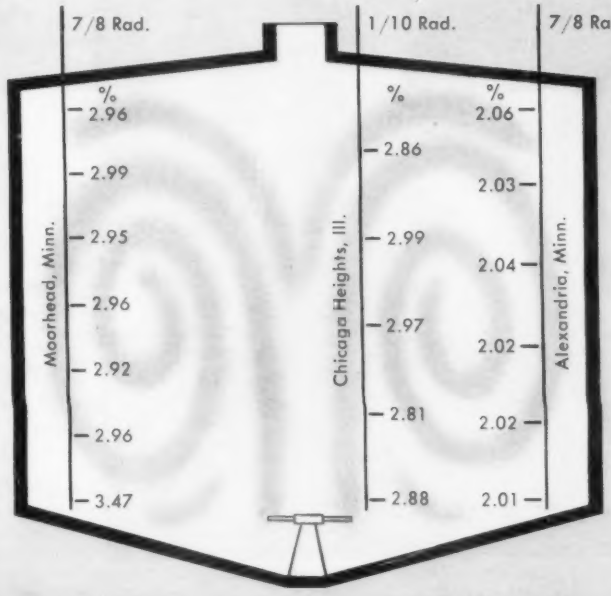
Unparalleled Savings... Provided by Continuous, Complete Homogeneity of Solids

Accelerated **CRP*** Sludge Digestion System

*A Trademark of CHICAGO PUMP COMPANY

...by the exclusive Gas Treating System

***Patent Nos. 2,777,815 and 2,786,025 ... others pending.**



Typical homogeneous distribution of solids in 3 plants under actual operating conditions.

The CRP* Accelerated Sludge Digestion System permits high loading of sludge solids to a digestion tank. Limited amounts of digester gas are recirculated through diffusers near the bottom of the tank and preferably at the center.

The entire primary digestion tank contents attain a homogeneous condition with intimate treating of the seed sludge, the raw feed sludge and the gas bubbles. Continuous diffusion of gas while transferring digested sludge maintains this homogeneity at all times.

CRP* is the *only process* to assure continuous, complete homogeneity of solids undergoing digestion. This system also eliminates scum problems by creating an ideal environment for accelerating the sludge digestion process.

Consulting Engineers are invited to request specific data direct from Chicago Pump Company, Department B, or by contacting Distributors located in most principal cities ... concerning the application of CRP* systems to plants under design or plants requiring expansion.

there are 21 CRP* systems in successful operation ... 10 more on order.

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

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MR. HORACE SHIRLEY TALKS ABOUT "OUR NO. 12"

Mr. Shirley is road superintendent for the town of Goffstown, N. H. He says:

"Our No. 12 is twelve years old and is in very good condition. There are over 20,000 hours of operation on it and in all this time we've never had a breakdown that held us up over three hours when it was supposed to be working.

"I believe that this is one of the finest pieces of equipment we have ever bought.

"We would not be able to keep our mountain roads open in the wintertime without the No. 12. Some of our roads up there have a twenty per cent grade. Sometimes the temperature goes to 35° below zero, and the motor still starts."

Now is the time to plan your fall and winter snow removal needs. Your Caterpillar Dealer will gladly give you any details you'd like—about the Caterpillar No. 12 Motor Grader—about matched snow clearing equipment. Call him today.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

FIND YOUR CATERPILLAR DEALER IN THE YELLOW PAGES

Caterpillar Motor Graders can be equipped to meet your exact snow removal needs. Goffstown has its No. 12 equipped with a mast-type snow wing. Others use snow plow stub wings, Domor Snow Blowers, Omsteel V-type Snow Plows, or, if snowfall is light, motor grader bulldozers. Here in one machine is fast snow removal in winter and efficient road maintenance the rest of the year. Caterpillar Motor Graders offer you real year-around economy.

CATERPILLAR

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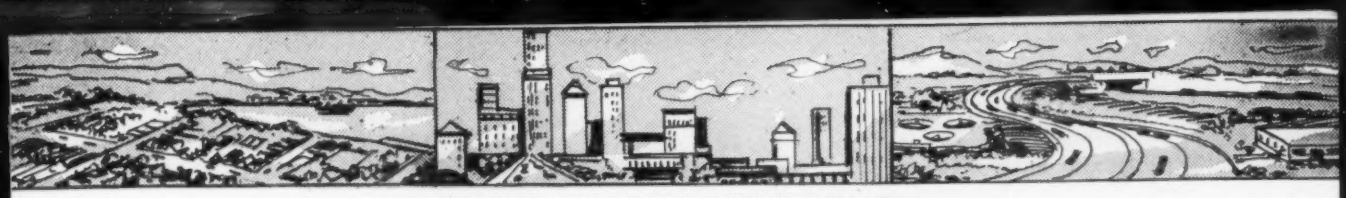
THE TAXPAYERS' BEST BUY



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BPA

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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

BRING ON YOUR RIVERS!

CLOW RIVER-CROSSING CAST IRON PIPE TAKES 'EM "IN STRIDE"!

EASY TO LAY. As easy to make up as a standard flanged joint. Lower labor installation cost because of ease of joint make-up and longer laying lengths.

ONLY A RATCHET WRENCH NEEDED. No split parts. Fewer parts—each joint consisting of one complete pipe, one solid follower ring, one solid ring gasket, bolts and nuts.

FULL 15° TURNING DEFLECTION with absolutely no reduction in the full internal opening area—therefore, no abnormal pressure-drops at deflected joints. Deflection stresses evenly distributed among all the bolts.

LONGER LAYING LENGTHS—approximately 18'6"—faster installation, lower costs. However, lengths may be varied to suit conditions. For example: 6 foot, 12 foot or other special lengths may be advisable to suit required curvature.

Mail coupon for complete information on Clow Ball-and-Socket River-Crossing Pipe. No obligation, naturally.

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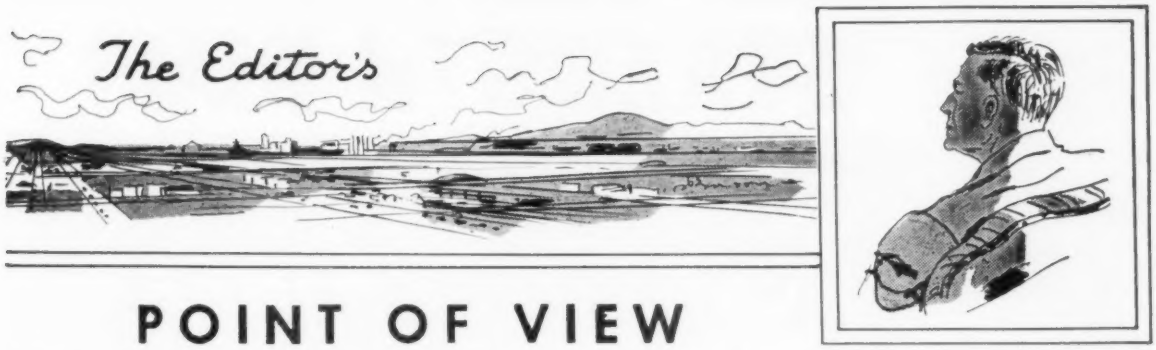


POINT OF VIEW

A Summer-Time Look at Snow and Ice Problems

THE MECHANICS OF keeping highways open and safe for travel under severe winter conditions are fairly well established. They are effective, granted the essentials of leadership, a responsive organization, plenty of reliable equipment and an adequate supply of chemicals. With few exceptions, our engineers have provided the leadership and the organization; in many cases they have lacked the necessary equipment.

Last winter was a rough and difficult one in many areas of the nation. Plows, trucks and other snow handling equipment had severe service. Much replacement is needed and now is the time, if it has not already been done, to order new and supplementary equipment and to provide for ample stocks of salt and/or calcium chloride.

Every year the need for adequate winter maintenance becomes more pressing as increased numbers of people commute by car to work; as householders rely on the use of even minor roads for food and other essential needs; and as modern living moves more and more to the suburbs.

Not even the Farmers' Almanac can tell what is coming this winter. We have always felt that it, like most forecasters, delights in gloomy predictions; but sometimes these come true and there is a heavy responsibility on our engineers to safeguard the public. So don't forget that needed new equipment.

Research to Everyone's Responsibility

IN CONSIDERING research, one is often tempted to consign it to the realms of institutions, such as colleges, experiment stations and foundations. This is perhaps natural because so much early work, especially in sanitary engineering, was done by these agencies. However, very worthwhile results have also originated with the equipment industry. Often because of business competition, basic data are kept secret until a package is ready for delivery. Then results have to be proved all over again in order that the public may be permitted to use the new method or device.

A broader base for research and development is needed. Many city water and sewage treatment plants are manned by gifted individuals with excellent training and experience and more than the usual insight into their problems. A few of the larger cities have devoted time and personnel to research and development work, but too few of them. More cities should recognize the potential of their skilled personnel and provide space, equipment, money and opportunity; and more state sanitary engineers should provide leadership and assistance.

Sound Water Operation Helps Bond Sales

MANY CITIES, now and in the near future, will require additional water supply and major distribution system improvements. The work will be financed by bond issues, with very rare exceptions. To aid in selling the necessary bonds at favorable prices, system operation must be sound. The universal use of water meters to insure that value is received for all water used is a basic element in good operation. It insures dependable income while reducing water waste.

Though this principle holds for all water-using communities, it is especially applicable to rural, county and township systems serving the increasingly growing exurbanite areas where per capita consumption is high and fluctuates seasonally. Often the first few years of operation are financially critical. Installation of meters at the time the lines are laid can be an important factor in establishing financial security for such systems and will also reduce some of the problems of operation.

Water and Waste Disposal Deficiencies

WATER IS SOMETHING most everyone wants and is fairly willing to pay for; water departments have had a long existence; engineering and management techniques are well known. So it is surprising, to say the least, to read the results of a country-wide survey recently reported by the AWWA relating to water utilities: one out of five is deficient in basic supply; two out of five need more transmission capacity; one out of three is deficient in pumping capacity; two out of five are deficient in treatment capacity; ground and elevated storage facilities show 29 percent and 43 percent deficiencies respectively; distribution improvements are required in 57.4 percent of the systems.

If this is the situation in respect to water supply, which is normally a money-making operation, what is the case in regard to sewerage and sewage treatment, which represent a direct and continuing cost, without any financial return? Certainly the deficiencies are more numerous, greater and fully as much in need of correction. Here is an area in which the needs for leadership and for action are evident.

STRENGTH PLUS

Chicago, Ill.—Cast Iron Pipe for installation of new water main under West Madison Street.

Corpus Christi, Texas—Cast Iron Pipe installation in filtration plant showing 48" discharge manifold which is connected to 48" Cast Iron city supply line.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

MODERNIZED **cast iron**

HIGH FLOW

You get BOTH with CAST IRON PIPE

*Here's the proof of flow

FLOW FACTORS FOR CEMENT LINED CAST IRON PIPE

LOCATION	SIZE	TEST SECT. IN FEET	VELOCITY F.P.S.	AGE YEARS	W & H "C" FACTOR
Bowling Green, Ohio	20"	45,592	0.7-2.4	New	142.5
Chicago, Illinois	36"	7,200	2.6-3.6	New	147
New Orleans, La.	12"	39,650	1.2-2.9	New	141
Corder, Mo.	8"	21,350	0.9-2.3	New	143
Univ. of Illinois	8"	400	3.14	New	150
Concord, New Hamp.	14"	500	1.7-2.2	New	151
Concord, New Hamp.	12"	500	2.0-3.4	11	142
West Palm Beach, Fla.	12"	500	3.6-5.4	15	139.5
Greenville, S. C.	30"	87,376	2.4-2.7	12	148.5
Corpus Christi, Tex.	30"	65,641	1.1-1.8	6	146
Summerville, S. C.	8"	500	1.98-2.43	13	142.5
Champaign, Illinois	16"	3,920	3.1-5.6	22	139.3

*Available upon request: Booklet containing flow test and tables on Cast Iron Pipe.

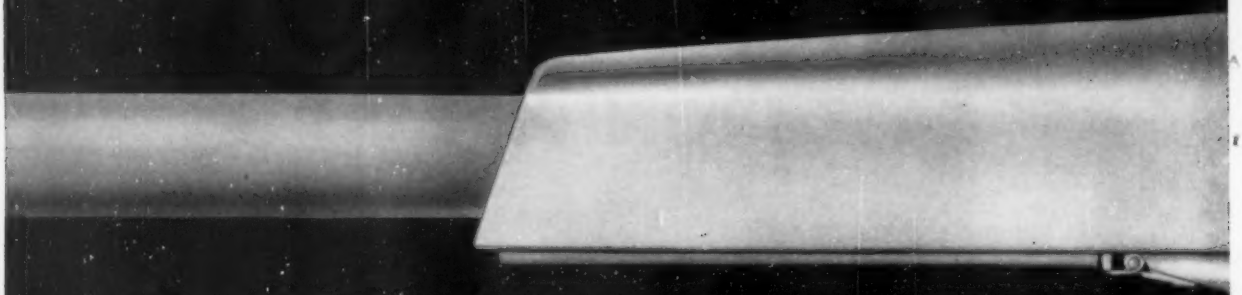
Here's the proof of strength

1. CRUSHING STRENGTH*. . . Standard 6" Class 150 cast iron pipe will withstand a crushing load, under standard tests, of 17,900 pounds per foot . . . important where heavy fill or shock from heavy traffic loads are encountered.
2. BEAM STRENGTH*. . . Settlement soil movement, or disturbance of the soil by underground construction places a heavy strain on pipe. A length of 6" class 150 cast iron pipe bears up under a load of 20,790 pounds and deflects over 2¼ inches.
3. BURSTING STRENGTH*. . . Tests prove that standard 6" class 150 cast iron pipe withstands internal pressure of 3000 pounds per square inch . . . providing a safety factor ample to resist high working pressures and water hammer.
4. JOINT STRENGTH . . . A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available to meet all conditions.
5. CORROSION RESISTANCE . . . Cast Iron Pipe resists corrosion . . . vital factor in its proven long life and dependability.

*Based on independent laboratory tests.

pipe FOR MODERN WATER WORKS

OBSOLETES ALL PREVIOUS

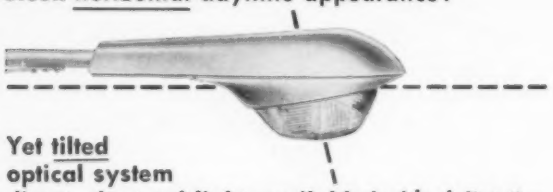


New Westinghouse

OV-25 *Silverliners*

WITH OR WITHOUT A BUILT-IN BALLAST

Sleek horizontal daytime appearance!



Yet tilted optical system directs the total light available in *ideal* distribution patterns. Gives more light per watt than any other comparable luminaire!

A roadway luminaire establishing new standards of design, application and cost-saving is now available from Westinghouse!

This new luminaire is the OV-25 *Silverliner*. It is engineered to virtual optical perfection! With features producing "custom application" of maximum lighting output—for practically all roadway areas requiring high illumination!

A one-piece *die-cast* aluminum housing permits the clean-lined Silverliner styling that heightens community pride—and gives Silverliners an almost unlimited service life!

Silverliner reflectors of Alzak® finished aluminum are contour-engineered precisely for the 400-watt mercury lamp—the most economical lamp for roadway lighting today! These reflectors snap rigidly into the housing in positive alignment!

Silverliner prismatic refractors achieve new excellence in the optimum control of total light output! And their edge overlaps the edge of the reflector—"uniting" the two—and eliminating the trapping and the waste of light that occurs at this juncture in all other designs!

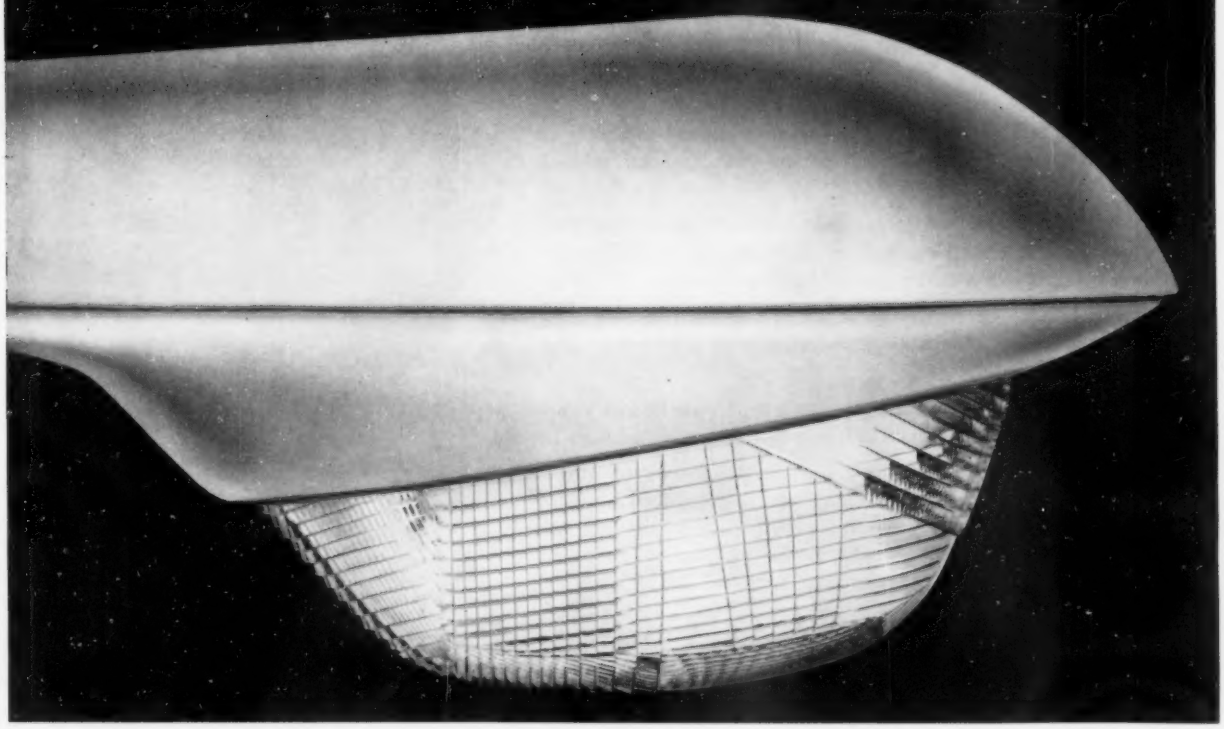
Then the die-cast aluminum refractor ring automatically "locks" the reflector-refractor assembly into precise, tilted optical focus!

Moreover, a resilient seal at the socket-opening, as well as at the reflector-refractor gasket, prevents the entry of bugs, dirt or moisture. The need for cleaning is minimized. As a result, this "double" sealing of Silverliners produces more *maintained* light than is *possible* by other luminaires, with openings around their socket!

Finally, Silverliners give either Type II or Type III distribution. And a simple socket adjustment lets you "toe-in" the beam! You can "custom focus" the light from *each* Silverliner, according to its location!

Silverliners first *deliver* and then *maintain* more light per watt—with optimum roadway coverage—than *any* other 400-watt luminaire available today!

400-WATT LUMINAIRES



Built-in Ballast model saves from $50 to $70 on every Silverliner installed!

With their own dual-voltage regulated output ballasts self-contained, Silverliners eliminate need for:

1—Transformer bases	4—All labor for their assembly
2—Pole-top fitters	5—Often, considerable wire
3—Mounting bands	6—Splicing time and labor

And, all installation and servicing from one ladder-position—*and from below*—creates additional savings!

Silverliner housings are merely mounted level. Tilted optical system alignment is automatic. Only two leads go to the terminal block. Installation time is cut as much as 60 per cent!

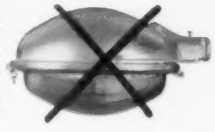
Maintenance costs cut up to 30%

The refractor-ring hangs open for easy access to the lamp. It is secure in open position but easily removed. And Silverliners' *completely* sealed optical system can cut the number of cleaning trips in *half!*

Call your Westinghouse Representative TODAY! Get your FREE Silverliner brochure. See, for yourself, the *startling* savings you get with Silverliners!

Or, write directly to Westinghouse Electric Corporation, LIGHTING DIVISION, Edgewater Park, Cleveland, Ohio. J-04461

1947 This first luminaire for horizontal-burning mercury lamps, introduced by Westinghouse, had a one-piece reflector-housing. It excelled at the time; but was discontinued because reflector-housings:

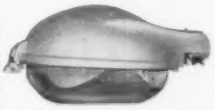


1 Require longer periods atop ladders for servicing. Make maintenance slow and costly!

2 Do not assure a positive seal. Need more frequent cleaning. Have high loss of efficiency!

3 Are easily dented—destroying the optical system and distorting light distribution!

1953 This first luminaire with a cast-aluminum housing and separate reflector was also introduced by Westinghouse. It vastly improved lighting efficiency, gave excellent maintained-light and cut maintenance costs!



1958 **New Silverliners with their tilted optical system now offer you a more modern appearance and increased efficiency. Look for Silverliners to establish new standards for all future roadway illumination!**

YOU CAN BE SURE...IF IT'S

Westinghouse

ONLY 4-IN-1 Doubles Multiplies

You command up to twice the refuse-disposal capacity of an old-fashioned "single-action" loader—with an International Drott 4-In-1.

You command the four basic refuse-handling actions that make sanitary landfill succeed in a big way. All at a fingertip touch of exclusive 4-In-1's machine-selector lever!

You increase the capacity of sanitary landfill sites—by controlled spreading, compacting, covering, and pressure-sealing refuse with a 4-In-1.

You get smog-freedom; rout rodents and insects; rid your community of dump-stench—all at one low cost with a 4-In-1.

You get versatility unlimited, to handle dozens of other municipal digging, 'dozing, grading, and loading jobs besides refuse disposal. Only the four sizes of 4-In-1 give you famous and exclusive pry-action break-out—for digging tough stuff where other loaders are "out of the running." And only the 4-In-1 has the performance protection of shock-swallowing Hydro-Spring!

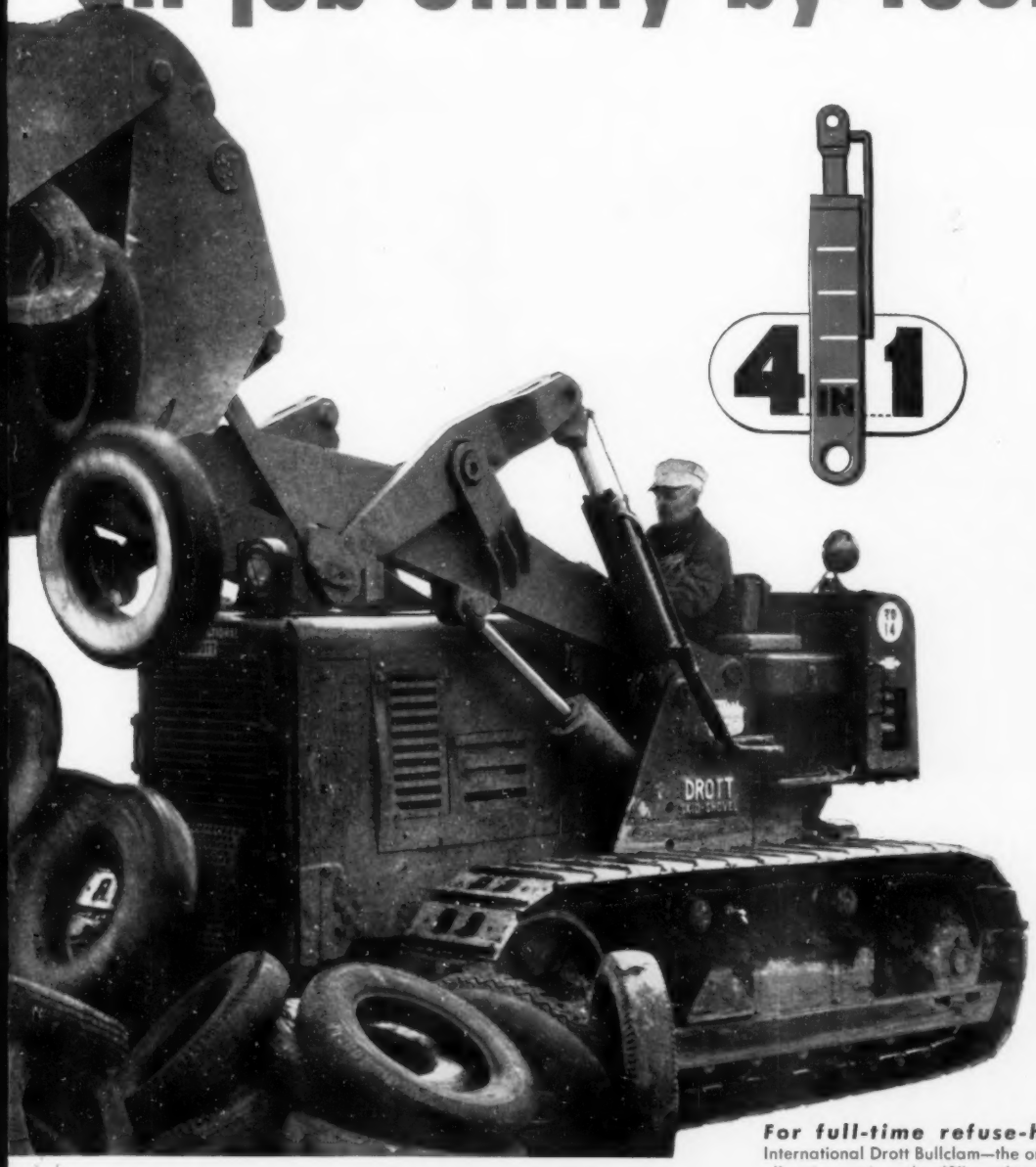
Measure the efficiency and economy gains your community can make with an International Drott 4-In-1—on sanitary landfill—in sand or gravel pit, or quarry—on street and park duties. Compare what it means to get 4-machine utility for one moderate investment. See your International Drott Distributor for a 4-In-1 demonstration!

Refuse-spreading action. Using 4-In-1's clamshell action, (see large picture), the operator readily picks up and carries such bulky, hard-to-handle cast-offs as old tires or tree stumps—and easily "layers" the material, to simplify covering and orderly disposal...Or he can evenly spread many materials, where dumped, using 4-In-1's radius-controlled bulldozer action.

Refuse-crushing action. To crush and compress cans, cartons, and similar materials, simply roll the lowered 4-In-1 forward—and apply compactor-plate ironing action, *on the go!* Increase down-pressure, hydraulically, to flatten stubborn stuff!

Refuse-covering-sealing action. Obtain cover dirt from "borrow" area or stockpile, using 4-In-1 Skid-Shovel or "carry-type scraper" action. Then spread the cover evenly, on the go. Iron down the cover, using loaded bucket weight plus hydraulic down-pressure on compactor plate.

refuse handling capacity all-job utility by four!



For full-time refuse-handling— the International Drott Bullclam—the only special-purpose, all-action sanitary landfill machine. (See view below.)

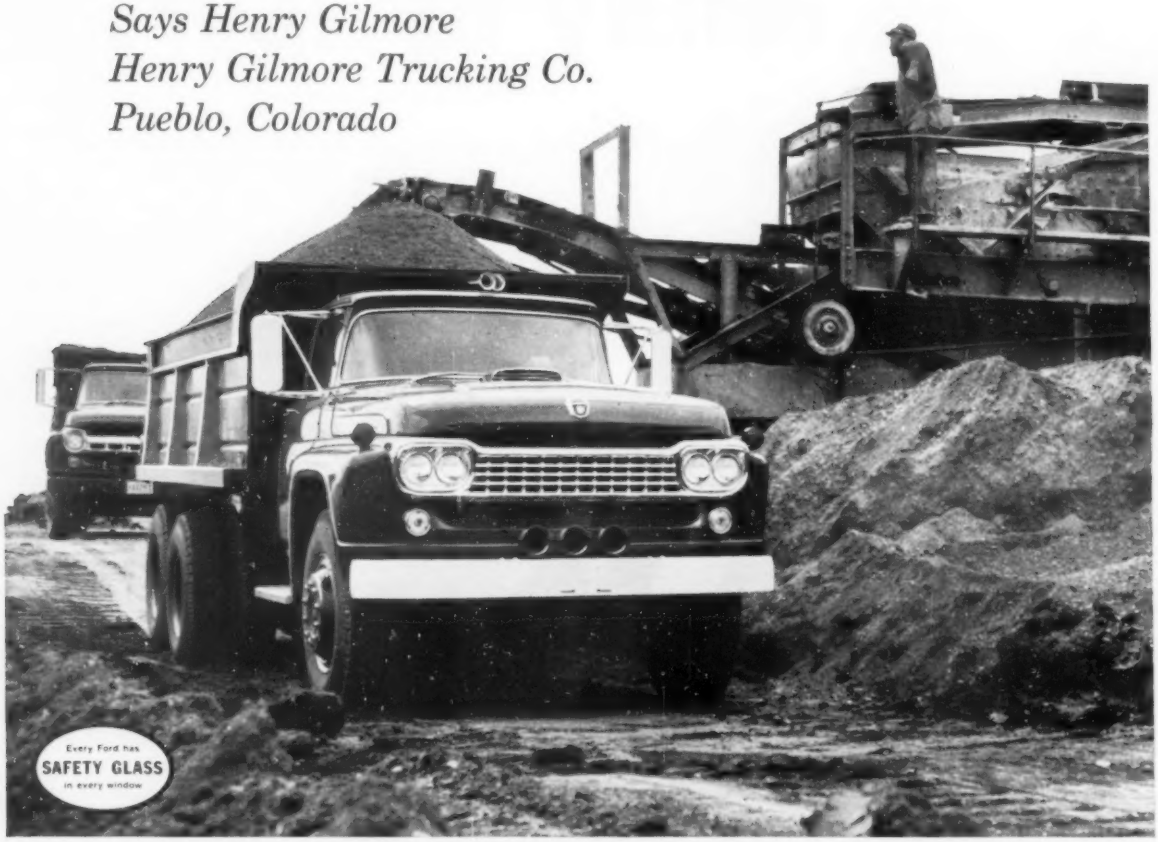
International Harvester Company, 180 N. Michigan Ave., Chicago 1, Ill.
Drott Manufacturing Corp., 3126 South 27th St., Milwaukee 15, Wis.

INTERNATIONAL HARVESTER

INTERNATIONAL® DROTT®

"FOR ENDURANCE, I KNOW YOU

Says Henry Gilmore
Henry Gilmore Trucking Co.
Pueblo, Colorado



"We've run our Ford trucks over 100,000 miles and have never had any major repairs!

"We've tried all kinds of trucks and our Ford tandems are the best we've ever owned. Our 24 Fords are T-750's and T-800's with 332-cu. in. Heavy Duty V-8 engines. We run 'em an average of 100,000 miles before trading, and never touch the engines except for minor tune-ups.

"Our '58 T-800's have 34,000-lb. tandem axles and carry 10 yards of gravel or hot mix. During the winter months, we hauled in a 30,000-ton mountain of gravel to feed the asphalt plant this spring. Now, we are using the trucks to carry black top from plant to spreaders for highway paving.

"My drivers really like and take exceptional care of their Fords. And power steering is a great driving help and safety factor.

"We like Ford's parts standardization and availability. With some trucks we've owned, it was like sending to a foreign country to get parts. We are completely sold on Ford trucks and have two new T-800 dumps on order. They'll be used on an uranium ore haul from the mountains."

Finance the easy one-stop way! Ask about the new **FORD FLEET TRUCK FINANCE PLAN!**

CAN'T BEAT FORD TRUCKS"

New '58 Ford T-800 dump takes on a 16-ton payload of "hot mix" at Broderick and Gibbons' asphalt plant, and another Ford tandem waits its turn.

Getting to the job quickly is important with the kind of loads carried in the Gilmore trucks. Shown below is one of their big Ford tandems dumping its load into an asphalt spreader.

Bring extra savings to your business . . . make your next truck a FORD!

Ford offers a complete line of over 360 truck models, ranging from pickups to giant tandems. And there are Ford Dealers almost everywhere, ready to help you select the truck best suited for your individual job. They're ready with modern service facilities, trained mechanics and low-priced Ford parts to keep your truck on the job, earning for you.

Ford trucks are your best buy! Ford's initial costs are *low* and resale value is traditionally high. The modern Ford Styleside pickups are the lowest-priced models available with full cab-wide body . . . giving you 23% more loadspace than traditional pickups.

Only Ford offers the economy of Short Stroke power in all engines, Six or V-8. And Ford's Heavy Duty V-8's offer new, advanced durability features. The modern Ford Six, available in Light and Medium Duty F- and P-Series trucks, is equipped with an economy carburetor that gives you up to 10% greater gas mileage.

Ford's rugged cab and chassis construction means these new '58s are built to last. All this plus the proven fact that Ford trucks last longer adds up to America's No.1 truck value.

See your local Ford Dealer for the latest in '58 trucks or the best in A-1 used trucks.

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . .

LAST LONGER, TOO!

See the Ford trucks on exhibit at the American Public Works Association Convention Municipal Auditorium, Kansas City, Missouri, from September 28—October 1. Booths B-15 and B-16

ONLY CATERPILLAR GIVES YOU THE OIL

Here is what you should know about its money-saving and operating advantages

How much better is the exclusive Caterpillar oil clutch than the ordinary clutch? It can be summed up in this short statement:

When the Caterpillar oil clutch is ready for *adjustment*, the ordinary clutch is ready for *replacement*. Experience in the field proves it.

In the years since 1954, when Caterpillar introduced this remarkable advance in earthmover power trains, owners all over the country have reported thousands of hours of oil clutch operation free of adjustment or repair.

Typical of these reports is this one from Myron Omernik, land improvement contractor of Custer, Wis.: "Our D7 has operated 5,100 hours without any oil clutch repairs or adjustment."

This performance record means two clear-cut money-saving advantages:

1. Virtual elimination of down time caused by clutch failure.

2. Greatly reduced repair costs.

But in addition to its economy features, the oil clutch also provides superior operation. Here is why:

1. A hydraulic booster on the D9 and D8, operated by clutch oil pump pressure, takes the effort out of clutch operation but retains clutch "feel."

2. Clutch "fade" because of overheating is practically eliminated. The oil in which the clutch parts run is pumped directly from the crankcase. This means the clutch temperature never rises above engine temperature.

3. A clutch brake helps match clutch and transmission speeds—making shifting easier.

Here, in brief, is how the oil clutch works:

Three metallic-faced plates are separated by oil films at all times except for the last revolution or two as the clutch is engaged. Oil enters the inner diameters of the clutch plates and circulates between them by means of grooves in the clutch facings, carrying away heat and reducing wear. All clutch parts are constantly running in oil.

The exclusive Caterpillar oil clutch is not an "extra"—it is *standard equipment* on the D9, D8, D7 and D6 Tractors, all Traxcavators, on the No. 12 Motor Grader and on the MD6 and MD7 Pipelayers. Yet it is an "extra" in *value* that is unmatched in the industry.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

IMPORTANT OIL CLUTCH FEATURES

Independent oil pump assures positive lubrication and cooling for clutch plates, bearings and other vital moving parts.

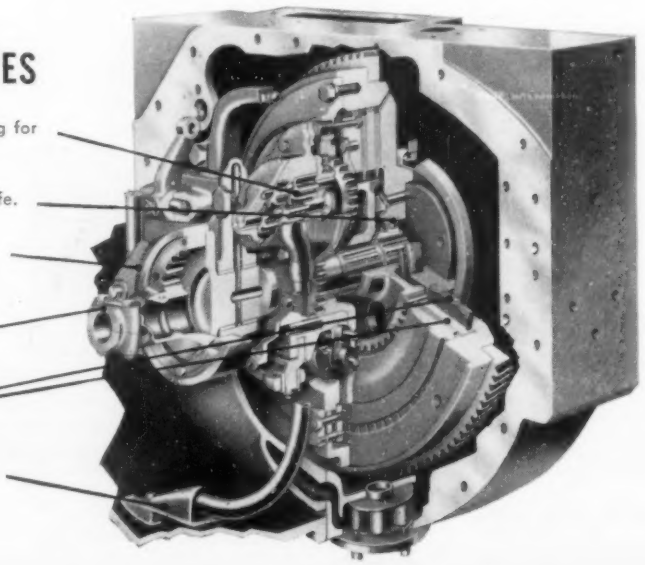
Heavy-duty bearings have extra capacity for long service life.

Clutch brake helps match clutch and transmission speeds—makes shifting easier.

Removable coupling allows clutch to be removed without disturbing engine or transmission.

Double clutch plates are metallic-faced for heavy-duty torque transmission.

Intake screens protect the oil pump from foreign material.



CLUTCH

CAT D9 TRACTOR: "We have operated this Cat D9 Tractor for 4,000 hours in the toughest kind of work without any repairs to the oil clutch," says Frank Hill of the Silva & Hill Construction Co., Los Angeles, California. "I just wouldn't consider buying a tractor without it now."

CAT NO. 955 TRAXCAVATOR: "In over 4,000 hours on our two hard-working No. 955 Traxcavators, we have made only one simple adjustment on an oil clutch and that took only about a half hour. It's much simpler than the old friction-type clutch," says M. J. Lutz of Bethel Park, Pennsylvania.

OWNERS REPORT TROUBLE-FREE OPERATION

CAT NO. 12 MOTOR GRADER: "Our No. 12 is starting its third season without interruption due to clutch trouble." With only one clutch adjustment in over 2,000 hours, Francis Bloomer, President of the John F. Bloomer Co., Appleton, Wisconsin, says, "We like the No. 12 with the oil clutch." This company, with 35 years of road construction work, owns a fleet of Cat-built equipment consisting of No. 12s, D9, D8s, DW21s.

CATERPILLAR

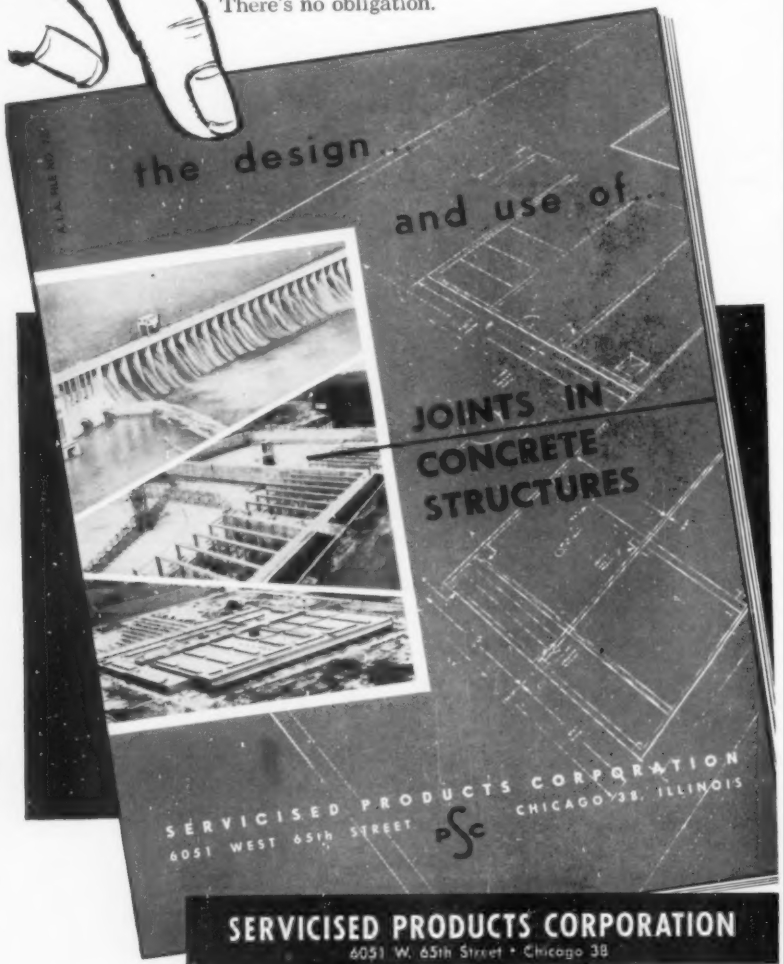
Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

LEADER IN EARTHMOVING RESEARCH

HERE'S COMPLETE, AUTHORITATIVE and PRACTICAL INFORMATION on

★ Design ★ Construction ★ Maintenance of Expansion, Contraction and Construction Joints in Concrete Structures!

Clip and return the coupon below for your free copy of this newly published manual on concrete joint design and construction. Here's complete information at your fingertips—the whole story on the design and use of joints in concrete structures. There's no obligation.



SERVICISED PRODUCTS CORPORATION
6051 W. 65th Street • Chicago 38

Fill out the coupon, or attach it to your letterhead.

gentlemen— **Send me, without obligation my free copy of "the design and use of JOINTS IN CONCRETE STRUCTURES."**

Name_____
Firm_____
Address_____
City_____ Zone_____ State_____

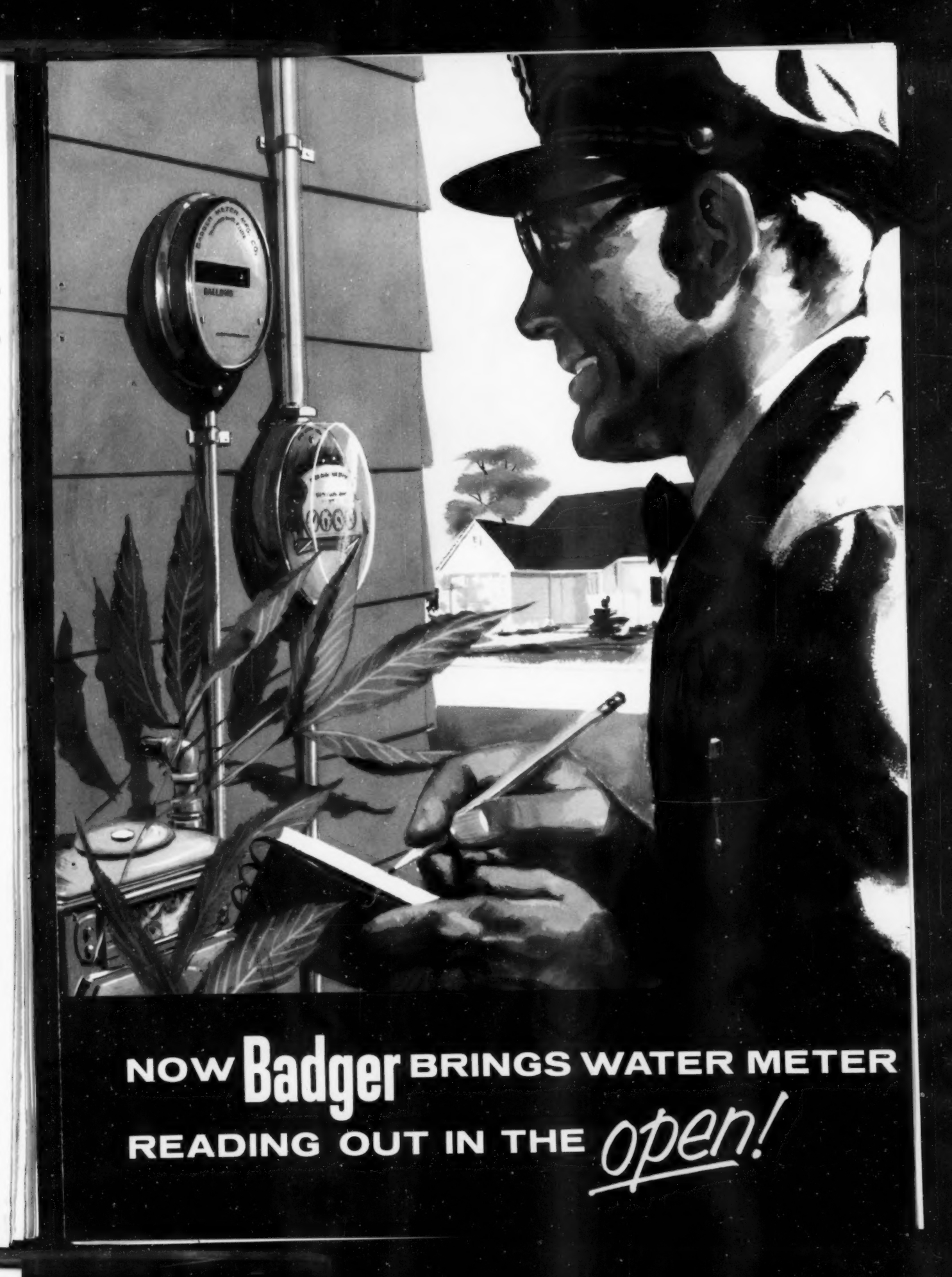
Leader in Public Works

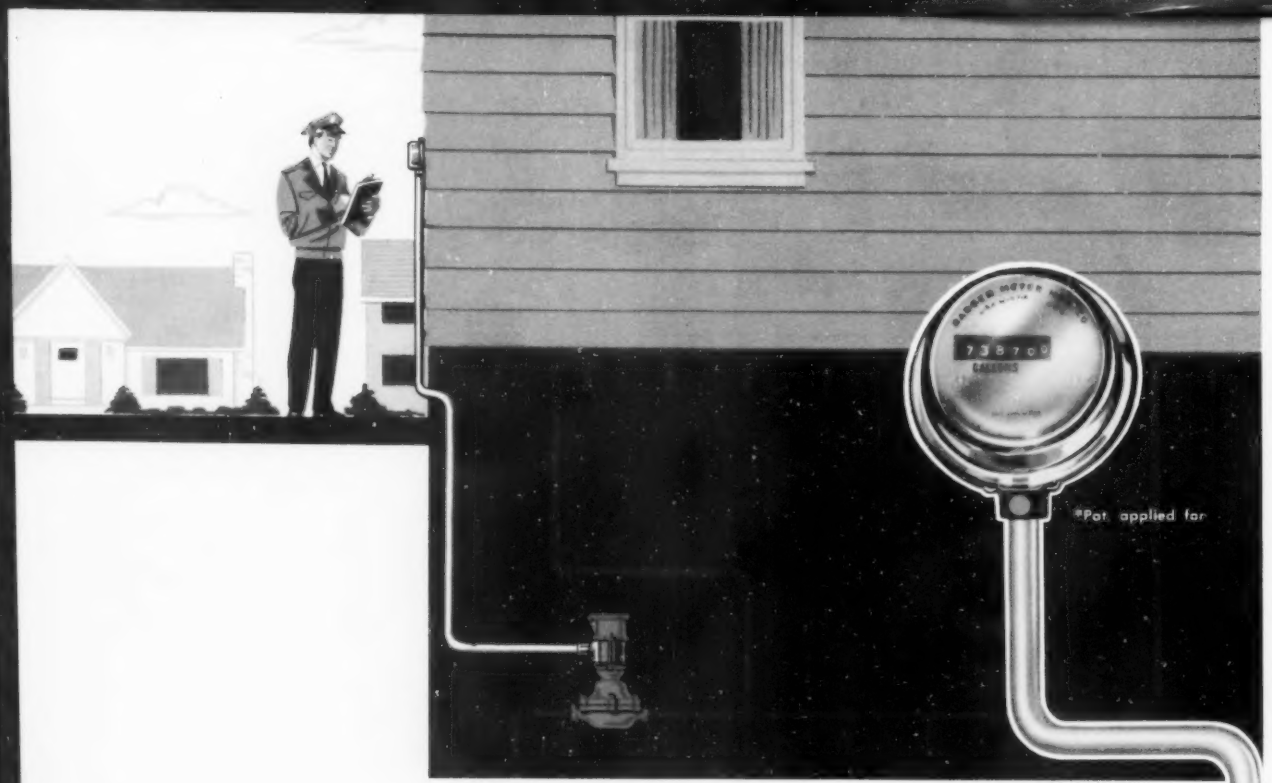
Edward L. Cyr is Engineer in Charge, Bureau of Traffic & Signals, Newark, N. J. He came to Newark in 1930 as Assistant Traffic Engineer; ten years later he became Traffic Engineer. In 1954 his department was assigned the added functions of street lighting, transportation, parking meters and the police signal system and he was made Engineer in Charge of the Bureau of Traffic & Signals, controlling all these functions. That year also saw the start of a greatly accelerated street lighting program which resulted in the installation of much new equipment designed according to good street lighting practice codes. The cover photo shows one of the new major street lighting installations in the downtown area.

A new type of reflectorized street sign is now being installed in downtown Newark as the start of a new city wide street sign program. The signs are to be mounted on existing poles at a 90° angle so that the oncoming motorist can immediately read the names of the two streets. These signs are the first of this type used and represent a new concept in street identification.

Like many other cities, Newark has a parking problem and in 1957 Mr. Cyr was appointed Acting Executive Director of the Newark Parking Authority. Under his direction, the downtown area is now switching over to an electronic traffic system; part of this new installation is also shown on the cover photo.

Mr. Cyr is a licensed PE in the State of New Jersey and is a member of the National Society of Professional Engineers. He is also a member of the ITE, the IES and the AIEE.


NOW Badger BRINGS WATER METER
READING OUT IN THE open!



REVOLUTIONARY

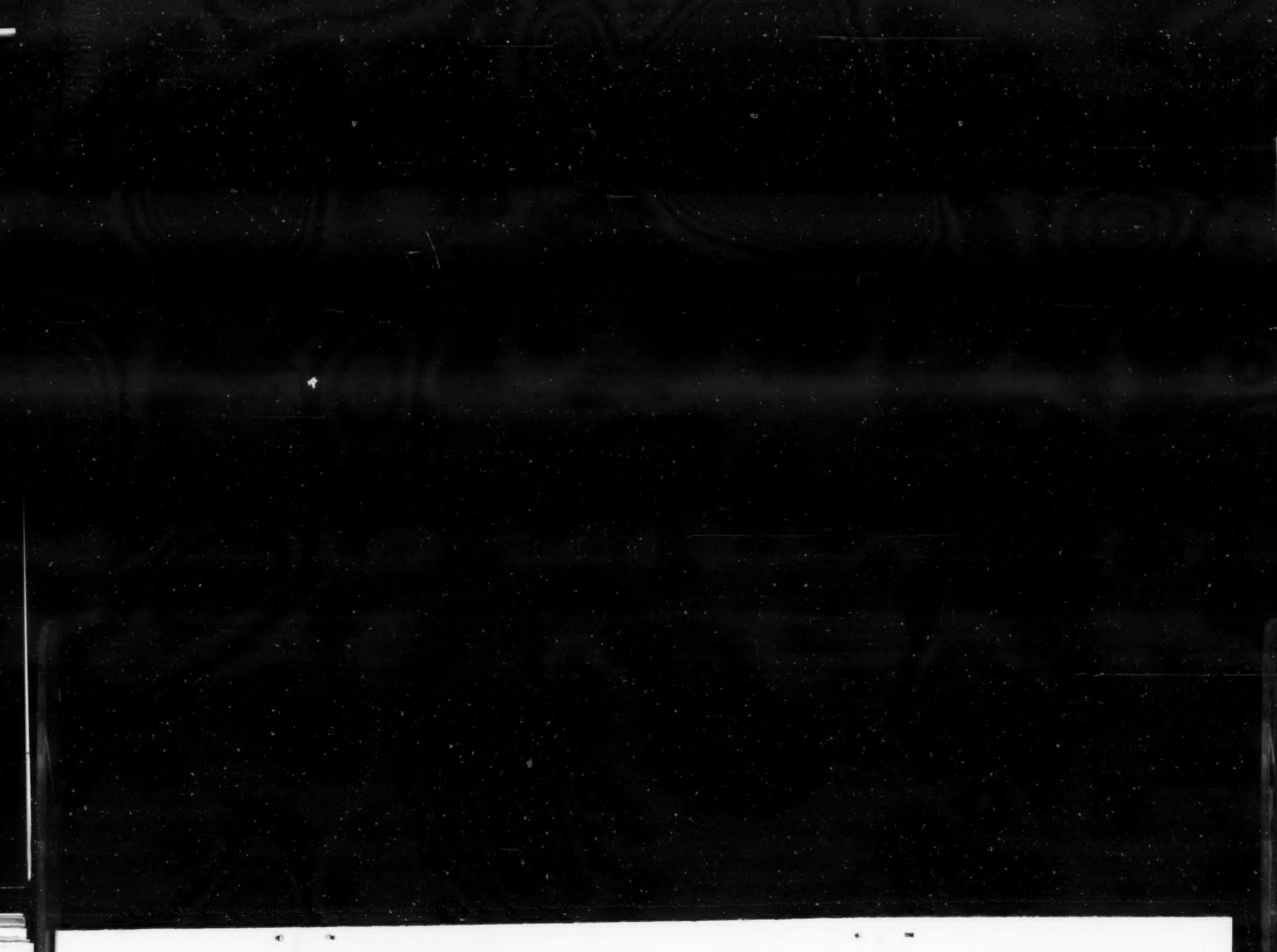
Badger *Read-o-Matic** register

eliminates the last big barrier to fast, efficient water meter reading

At last water meter reading has come of age. Badger's revolutionary Read-o-Matic brings it *out in the open* — the first practical *outdoor* register in the industry.

By separating the metering from the reading, and bringing the register itself up and out of the house, Badger offers faster, lower cost reading never before possible. Add still more benefits . . . long, service-free life . . . low initial cost . . . and simple installation . . . that mean tremendous savings in time and money as well as better service and customer good will.

For the first time, your water department will have a truly modern meter reading system . . . through the exclusive Badger Read-o-Matic.



RESIDENTIAL

NO MORE "lockouts"

NO MORE access problems

NO MORE in-house accidents

NO MORE inconvenienced customers

NOW 100% meter reading in ½ the time —and no wasted calls

Badger's Read-o-Matic makes the seemingly impossible *possible:* every call is a "mission accomplished." The meterman no longer depends on the customer to be home to take his reading. By ending the tedious, time-consuming phases of meter reading, the Badger Read-o-Matic makes it possible for every meterman to complete his metering route in half the time . . . completing every call *every time.*

Strategically located reading stations for new shopping center

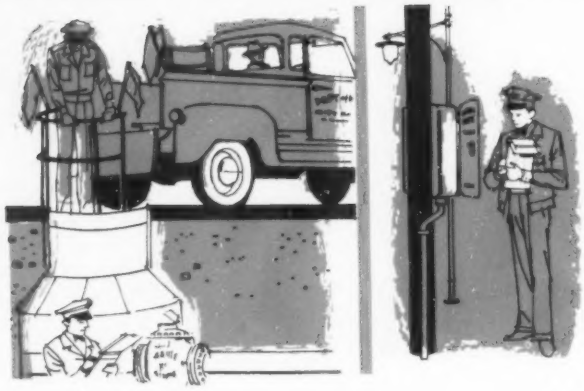
CON

The Badger Read-o-Matic can be placed as far as one-half mile away from the meter itself. This makes it ideally suited for commercial use, and introduces a new concept in meter reading: the reading station.

No dream — this new concept will soon be operating in the Mayfair Shopping Center in Milwaukee, where 85 stores are served. Each store will have a meter at the service and another at each air conditioner. These meters will be connected to the central reading station for each section . . . for easy, convenient, rapid reading.

At right: Typical layout of central reading station serving 10 meters is outlined in color on aerial view.

Architectural drawings courtesy of Grasshold & Johnson, Milwaukee, Wis.



The Badger Read-o-Matic's easy access at all times effectively reduces reading costs, eliminates the time-consuming, sometimes dangerous chore of reading inconveniently located meters. In many cities, for example, large water meters are under the streets. Meter reading involves 3 men and a truck to barricade the street, flag down traffic and go down a manhole to read the meters.

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a centralized m covering severa

Badger's Read-o-M of strategically lo — covering sever entire community could be done by to corner reading

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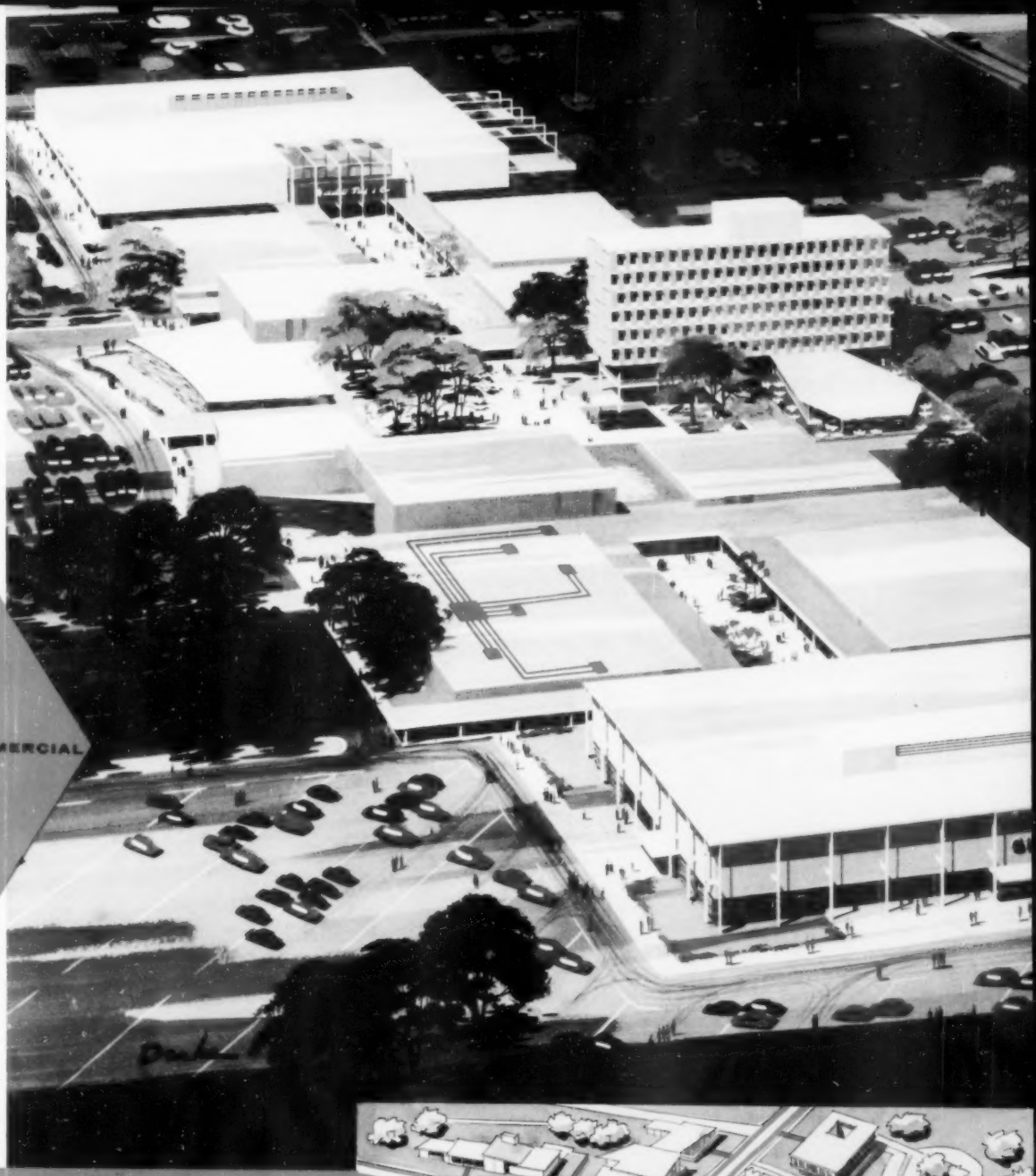
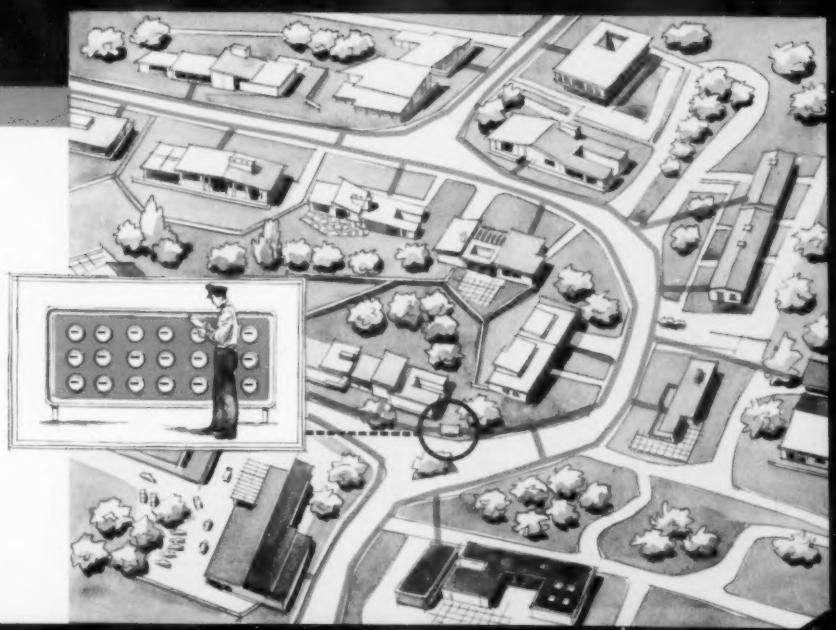
COMMERCIAL





RECAST

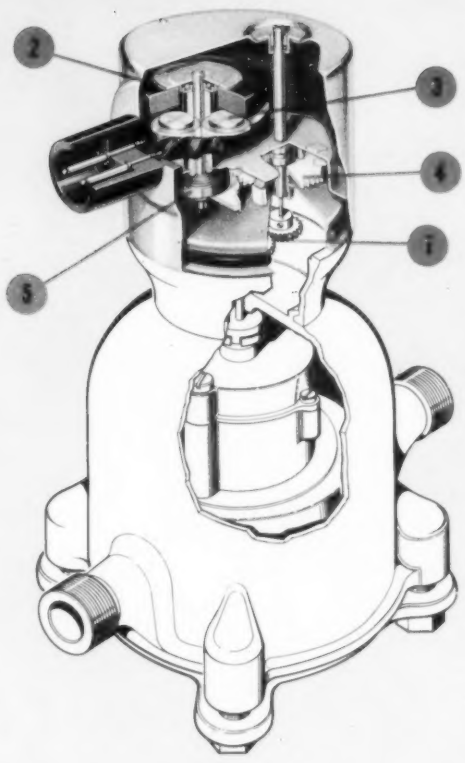
tralized meter-reading station
ring several city blocks.

r's Read-o-Matic makes possible a system
ategically located meter-reading stations
vering several city blocks throughout an
community. The periodic meter reading
be done by one man, making his rounds
ner reading stations.

Behind the revolutionary register . . . a self-contained generator

Operation is precise and fool-proof. The Badger Read-o-Matic is powered entirely by the meter to which it is attached.

Water passing through meter (see diagram at right) turns disc spindle to activate gears (1) that turn a magnet (2) in generator. This magnet rotates above 6 coils (3) that have poles within them. Drive gears (4) turn until they "run out of teeth." Immediately the driven gear is released under tension of torque spring (5). Quick escape of magnet generates the pulse on return kick of magnet over the coils and a three-volt pulse is transmitted by wire to Badger Read-o-Matic register.

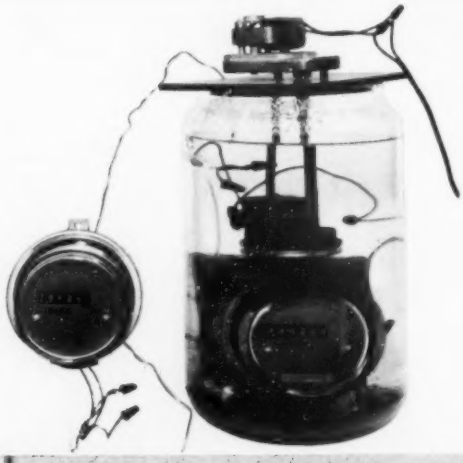


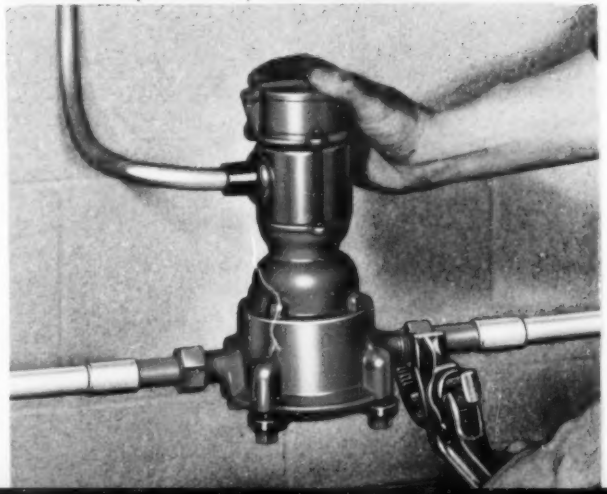
Patents applied for in U.S.A. and foreign countries.

. . . the result of extensive torture tests — in the laboratory and in the field

Badger's trained staff of water meter experts were merciless in their testing of the Read-o-Matic. They exposed it to 25 degrees below zero . . . operated it submerged (generator entirely open and precisely driving two registers as pictured) . . . sent millions of gallons of water through pilot models to test accuracy at a distance of two miles . . . pushing for performances far beyond the ultimate demands of Read-o-Matic users. And throughout all the rigorous tests, Badger Read-o-Matic never missed a pulse . . . never failed to accurately record every ounce of water that flowed through the meters.

The Badger Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to Read-o-Matic register.





Research makes the big difference in the meters Badger builds . . .

Here at our new 56-acre home in Milwaukee, research has paralleled Badger's 50 years of experience . . . *highly specialized water meter* experience . . . to develop meters that excel around the world in accuracy, durability, dependability and low maintenance cost. Here the precision achievements in water meter design are created and reach final production. From our engineering and research laboratories have come such Badger *firsts* as the self-locking anti-fog register cover . . . the exclusive Badger dovetail thrust roller insert . . . and now the remarkable new meter-register that finally brings meter reading *out in the open* — the Badger Read-o-Matic!

● *For further details or an actual Read-o-Matic demonstration, see your Badger representative — or write us direct.*

Water is Vital

Badger Water Meters

4545 WEST BROWN DEER ROAD • MILWAUKEE 18, WISCONSIN

Ball Bearing Design. Reduces operating torque more than 50%! Less maintenance!

"O" Ring Seals. No stuffing box! Packless, dry-top design! Eliminates customary maintenance of packing. Greatly reduces friction while assuring complete, *permanent* lubrication of operating mechanism.

Direct-Acting Rod. Operates main valve without auxiliary connections. Made of special steel, sleeved with bronze at the "O" ring.

FEATURES OF ASSURANCE

with Darling B-50-B Hydrants

Extra Large Barrel. Delivers water at the nozzles with no appreciable pressure loss!

Integrated Main Valve Assembly. Designed for easy, complete removal of all working parts on the hydrant rod!

Positive Multi-Port Drainage. Unique design with automatic line-pressure flushing at every opening and closing makes stoppage or freeze-ups virtually impossible.

For complete details on the outstanding B-50-B hydrants, other major features, types, sizes, ask for Bulletin 5710.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

CreZon Keeps A'G'A Signs Waterproof

● Turnpike signs take a beating 24 hours a day! But despite scorching sun and freezing winds, GPX* Green with its CreZon overlay really stands up.

This is what the Elastic Stop Nut Corporation of America has found from its extensive use of CreZon along Eastern highways.

The grainless, two-sided GPX Green withstands the worst weather without checking, splitting or grain rise. This CreZon overlaid plywood saves labor in the shop because it works easily and paints quickly.

Next time you construct road signs—whether large or small—construct them of CreZon overlaid plywood.

*GPX is a registered trade mark of Georgia-Pacific Corporation

the permanent protective overlay for plywood

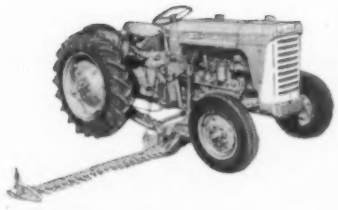
CreZon®

CreZon overlaid plywood is available from leading plywood manufacturers under various brand names

CROWN ZELLERBACH CORPORATION
343 SANSOME STREET SAN FRANCISCO CALIFORNIA

OLIVER

Nation's biggest lawn-mowing job handled by Oliver tractors



Oliver 550 with No. 57 mower is the popular tractor for right-of-way maintenance. With travel speeds up to 15 m.p.h., heavy-duty cutter bar gives high-speed, precision mowing. Hydraulic control raises or lowers cutter bar from 45° below horizontal to vertical. Five- and six-foot swath sizes. Automatic safety release.

New Jersey's new Garden State Parkway is 173 miles of driving splendor. Wide, grass-covered center islands, outer shoulders and bays total up to enormous acreage—probably the greatest lawn-mowing job in the nation!

Handling the king-size maintenance job is an Oliver fleet of 36 tractors! Pulling PTO-operated rotary mowers or with side-mounted sickle bar mowers, they keep the Parkway beautifully park-like in appearance at all times.

The Oliver Model 550 in the picture above shows how these wheel tractors are ideally sized for *production* mowing work. The Olivers work even the very steepest of slopes with speed, safety and efficiency.

Big contributions to daylong peak operator efficiency are Oliver's masterful maneuverability and operating ease with recirculating ball steering...comfortable rubber-torsion spring seat...easy-operating controls...positive-action double-disc brakes.

Whatever the size of your mowing job, whatever the *extra* jobs you want performed—the Oliver 550 tractor will tool-up with the attachments you need to do the work faster at rock-bottom costs. See your Oliver distributor.

OLIVER **THE OLIVER CORPORATION**

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

fastest growing acceptance in

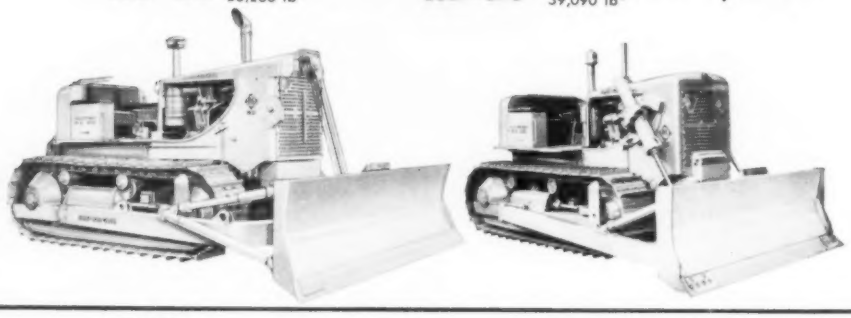
Allis-Chalmers crawler tractors for every application

...plus a complete line of matched bulldozers, side booms, mounted rippers, other attachments.

*All weights approximately as illustrated. Twelve other tractor models available.

HD-21 225 net engine hp torque converter drive 56,260 lb*

HD-16 torque converter drive 150 net engine hp 39,090 lb* | all-gear drive 141 belt hp



Allis-Chalmers tractor shovels in a full range of bucket sizes...

up to 7-cu-yd capacity to match requirements for various materials and job conditions.

4-CU-YD **HD-21G** 225 net engine hp 66,500 lb

3-CU-YD **HD-16G** 150 net engine hp 47,800 lb

Allis-Chalmers motor scrapers and wagons...

five models that offer major advantages on big jobs or utility work.

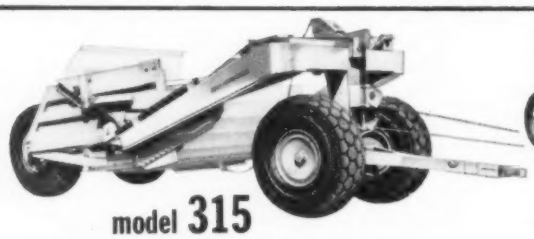
TS-360
280 hp
Struck — 15 yd
Heaped — 20 yd

TW-360
280 hp
Struck — 17 yd
Heaped — 24 yd

TR-260
200 hp
Struck — 11 yd
Heaped — 15 yd

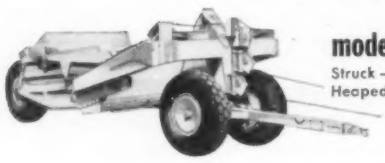
Allis-Chalmers pull-type scrapers...

the only line with low bowl, high apron lift, forced ejection in every size.



model 315
Struck — 15 yd; Heaped — 20 yd

model 108
Struck — 8.4 yd
Heaped — 12 yd

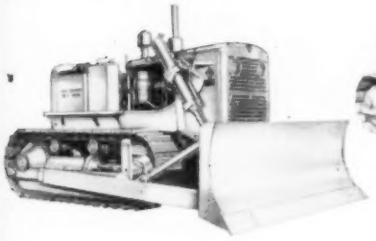


model 106
Struck — 6.1 yd
Heaped — 8.5 yd

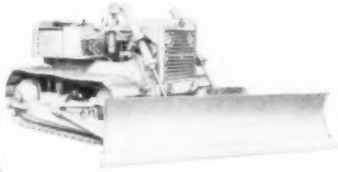
model 44
Struck — 4 yd
Heaped — 5.5 yd

the business . . . ALLIS-CHALMERS CONSTRUCTION MACHINERY

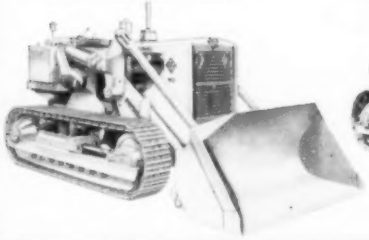
HD-11 94 belt hp 25,960 lb*



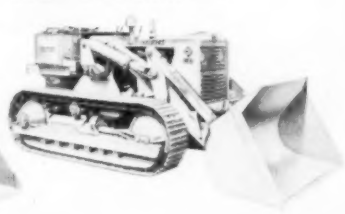
HD-6 63 belt hp 16,470 lb*

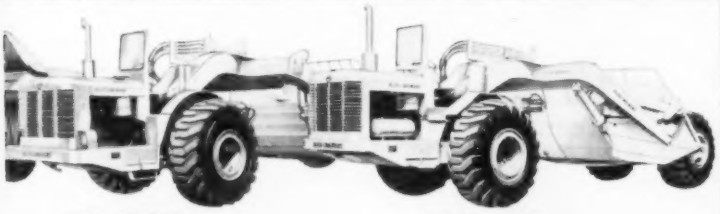


2¼-CU-YD
HD-11G 111 net engine hp 32,000 lb



1½-CU-YD
HD-6G 72 net engine hp 19,600 lb



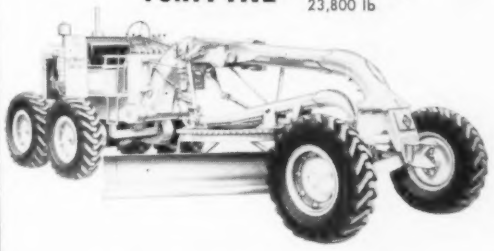


TS-260
200 hp
Struck — 11 yd
Heaped — 14 yd

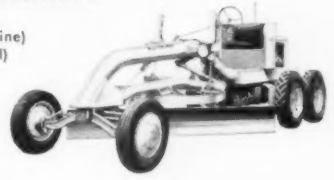
TS-160
155 hp
Struck — 7 yd
Heaped — 9½ yd

Allis-Chalmers motor graders...
designed for comfort-conscious operators and cost-conscious owners.

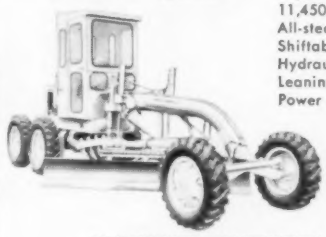
FORTY-FIVE 120 brake hp 23,800 lb



model D standard
50 brake hp
8,800 lb (gasoline)
9,350 lb (diesel)



model D special
50 brake hp
10,900 lb (gasoline)
11,450 lb (diesel)
All-steel cab
Shiftable moldboard
Hydraulic scarifier
Leaning front wheels
Power circle turn



ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

DESIGNED AND BUILT FOR HIGH-VOLUME PERFORMANCE YOU CAN DEPEND ON

Look ahead... *move ahead*...and stay ahead with ALLIS-CHALMERS

a pleasure

U.S. cast iron PIPE

FOR WATER, SEWERAGE AND

to handle!

True. A balky wife can be a problem.
But Tyton Joint® pipe . . . never!

In fact, Tyton Joint pipe is so easy to assemble that even inexperienced crews pick up the know how quickly. Only one accessory needed—a specially designed rubber gasket that seats into the bell. The connecting pipe slides in, compresses the gasket to give a tight, permanent seal.

No bell holes. No caulking. No nuts or bolts to fasten. And Tyton Joint pipe can be laid in rain or a wet trench.

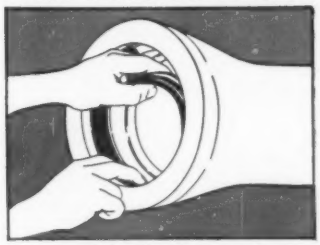
Want full details on how Tyton Joint pipe can save *you* money, time and trouble? Call or write today.

U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

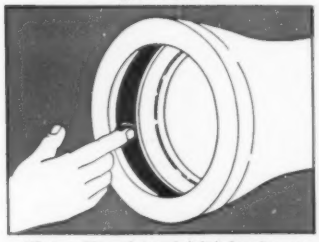
A WHOLLY INTEGRATED PRODUCER FROM MINES AND BLAST FURNACES TO FINISHED PIPE

U. S. TYTON JOINT

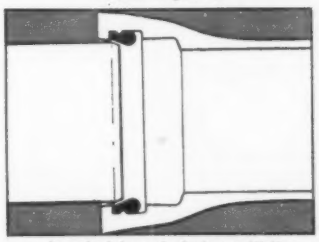
ONLY FOUR SIMPLE ACTIONS



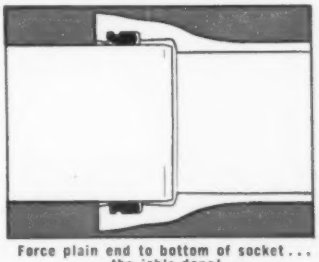
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

6" Tyton Joint pipe for golf course sprinkler system in Illinois

INDUSTRIAL SERVICE CAST IRON

AUTOMATION IN SCIENTIFIC PLANNING MANAGEMENT

The full title of this text, which is reproduced in offset typing, is "A Guide to Efficient Scientific Management Planning for Supervisors and Administrators" with a subtitle "how to analyze for office automation and electro-data processing." The author is a senior administrative assistant in the Bureau of Engineering, City of Los Angeles. The material presented here has been used for advanced instruction in the School of Public Administration, USC. It stresses the fact that management has two main functions —planning and control.

After preliminary information on the process of planning, utilizing automation, with information on types of computers and areas for their use, there are two excellent sections on conducting management surveys and on analyzing costs and selling the plan. There are three appendices and a bibliography.

The text comprises 83 single-spaced pages; the price is $3.25. Address the author, John W. Sullivan, 4540 Irwindale Ave., Covina, Calif.

HIGHWAY STATISTICS 1956

This bulletin presents the 1956 statistical and analytical tables of general interest on motor fuel, motor vehicles, highway-user taxation, financing of state and local highways, highway mileage and Federal aid for highways. Copies are $1 each and are available from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.

1958 MUNICIPAL YEAR BOOK

The 25th annual Municipal Year Book is a comprehensive review of municipal government in the United States. The 1958 edition contains 24 major tables with information on the organization, personnel, finances, and activities of cities in the United States. Highlights include special sections on municipal debt and public improvements planned and financed for the next five years. The municipal debt section presents the latest issue of general obligation, revenue and special assessment bonds issued in 1957 by 550 cities over 10,000 population and shows the dollar amount of bonds issued for sewers, water lines, off-street parking, street lighting, and other types of improvements. Data for 616 cities over 10,000 population show the public improvements definitely planned and financed for the five-year period of 1958-1962 by sewers, water lines, public buildings, and other types; estimated cost; and methods of financing by current revenues, general obligation bonds, and other sources.

New information is presented on special censuses for cities over 5,000 population, annexations, and other metropolitan area developments; employee organizations in cities over 10,000; and types of public improvements required for new residential subdivisions before the plat can be approved by the city government.

Orin F. Nolting and David S. Arnold are the editors. Published by the International City Managers' Association, 1313 East 60 Street, Chicago 37, Ill.; June, 1958; 598 pp; $10 postpaid.

THEORY OF STRUCTURAL ANALYSIS AND DESIGN

This textbook by Dr. James Michalos, Professor and Chairman of the Civil Engineering Dept. at NYU, integrates the theory, methods and tools of structural analysis, and related design concepts. Throughout, classical and modern numerical methods are applied to obtain exact analysis. The book relates methods of analysis to design procedures and mathematical treatment to physical concepts and behavior. It contains 552 pages, with 345 illustrations and 32 tables and is priced at $12. Copies are available from The Ronald Press Co., Book Publishers, 15 East 26th St., New York 10, N. Y.

ANNUAL REPORT OF NEW ORLEANS

The City of New Orleans, La., has recently released a very fine Annual Report on their accomplishments during the past 12 months. Some of the developments under construction or near completion include the following: Civic Center development; Terminal Building at Moisant Airport; Main Public Library; Assembly Center; Youth Study Center; and in addition the city government has continued to produce more and better municipal services.

Nationwide Sales and Service!

available in all principal distributing centers

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ALASKA (See Washington)
ARIZONA Equipment Sales Company, Phoenix
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Mingolla Machinery Company, Concord
NEW JERSEY Dale & Rankin, Inc., Hanover
NEW MEXICO
N. C. Ribble Company, Albuquerque
NEW YORK
J. C. Georg Construction Equip. Co., Syracuse, Schenectady, Lisbon
P-D Service, Inc., Pavilion, Buffalo
H. O. Penn Machinery Company, Inc., New York, Poughkeepsie, Westbury, Long Island
NORTH CAROLINA
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Northwestern Equipment, Inc., Fargo, Minot
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Feenaughty Machinery Company, Portland
PENNSYLVANIA
Watson Equipment, Inc., Pittsburgh
Ransome Corporation, Philadelphia
SOUTH CAROLINA
Ray Long Equipment Inc., Columbia, Greenville
SOUTH DAKOTA Sioux Road, Inc., Sioux Falls
TENNESSEE
Tri-State Equipment Company, Memphis
Power Equipment Co., Chattanooga, Kingsport, Knoxville
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Equipment Supply Company, Inc., El Paso
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Rocky Mountain Machinery Co., Salt Lake City
VERMONT Mingolla Machinery Company, Barre
VIRGINIA
Rish Equipment Company, Richmond, Roanoke
WASHINGTON
The Carrington Company, Seattle
Feenaughty Machinery Co., Seattle, Spokane
WEST VIRGINIA
Rish Equipment Co., Bluefield, Charleston, Clarksburg, Parkersburg
WISCONSIN
Drott Tractor Company, Inc., Milwaukee
WYOMING
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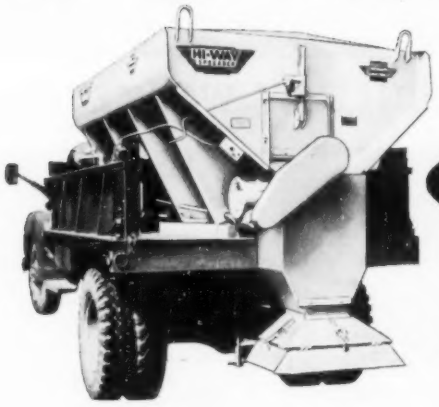
HAWAII
Edward R. Bacon Co. of Hawaii, Ltd., Honolulu

HI-WAY SPREADERS Now Ready for Ice Control Demonstrations!

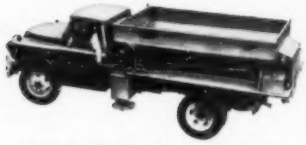


MODEL "E"

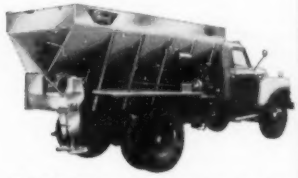
DUMP BODY MOUNTED
With side or rear mounted engine.

TRUCK MOUNTED
With side mounted engine or PTO drive.

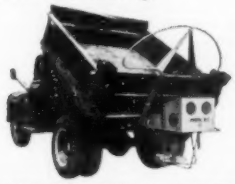
HI-WAY Ice Control Spreaders To Fit Every Specification!



Model Y—Front end spinner, side mounting with oscillating conveyor—lets you see what you're doing.



Model Y2—Reversible body provides front spinner location for ice control—rear corner location for seal-coating.



Model DD—Tailgate mounted spreader for quick ice control treatment and seal-coating.

- *New, Low Center of Gravity*
- *24″ Conveyor Width*
- *Smooth Material Flow*
- *Quick Positive Control*
- *High Angle Sides Prevent Bridging*

- **Heavy duty, hi-strength roller type conveyor chain. (Made exclusively by Highway Equipment Company for Hi-Way Spreaders).**
- **Greater lateral and vertical side bracing.**
- **Optional and accessory equipment to fit every highway department need.**

Highway and street department engineers: Now, before you prepare specifications for new ice control equipment, watch a demonstration* of the Hi-Way Model "E" Spreader. Check the advantages of the wider 24″ conveyor width which permits a smoother, even flow of any type of material you will spread. See how a lower spinner height aids traction—gives wider and better controlled coverage at intersections and in traffic. Find out how this versatile spreader handles seal-coating, dust control and road stabilization jobs without major equipment changes!

Our Business Is S-P-R-E-A-D-I-N-G!

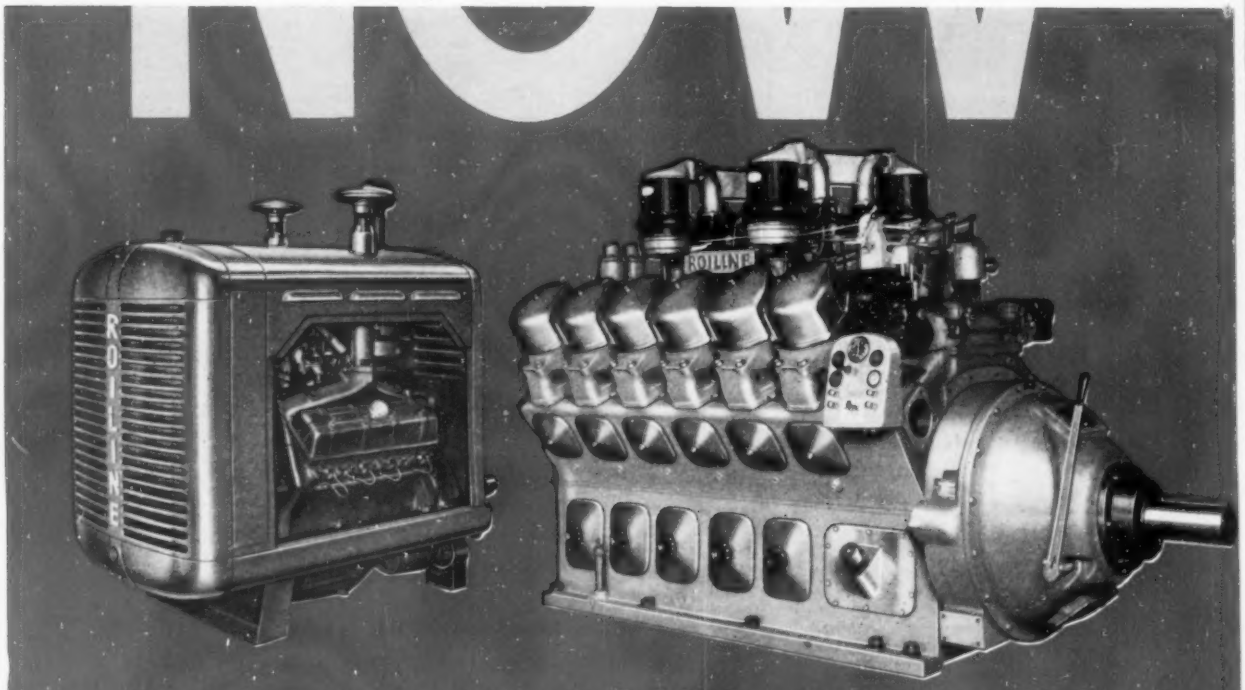
- New Management
- New Distribution
- New Nationwide Service Facilities

*Look on the adjoining page for the distributor nearest you.

HIGHWAY EQUIPMENT COMPANY
601 D. AVE. N. W. CEDAR RAPIDS, IOWA

NOW

ROILINE ENGINES (formerly LE ROI) ARE BUILT BY WAUKESHA.....



8-Cylinder H-540 ROILINE Unit—to 163 hp

V-12 L-4000 ROILINE Engine—to 685 hp

THESE FORMER LE ROI MODELS BECOME WAUKESHA ROILINE ENGINES

Model	Bore and Stroke	No. of Cyls.	Disp. Cu. In.	Max. Torque Lb./Ft. @ RPM	Brake Horsepower at Engine Speeds Indicated									
					600	800	1000	1200	1400	1600	1800	2000	2200	2400
H540	4½ x 4¼	8	540	454.... 900		68	87	105	122	138	151	164	173	178
H844	5¼ x 4⅞	8	844	671....1500		113	145	177	205	231	255	274	290	299
F1500	6¾ x 7	6	1503	1165.... 650	134	176	214	230						
H2000	6¾ x 7	8	2004	1590.... 650	180	240	280	300						
L3000	6¾ x 7	12	3006	2420.... 650	275	360	435	460						
L3460	7¼ x 7	12	3468	2750.... 900	305	416	527	608	635 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	3110.... 900	345	471	595	685						

These are engine ratings on LP Gas . . . send for Power Chart with ratings for engines and complete power units operating on natural gas, LP Gas, and gasoline.

WAUKESHA MOTOR COMPANY

Waukesha MOTOR

.... under famous Waukesha Quality Control

ROILINE ENGINES
(formerly Le Roi)

THE ADDITION of these well-known gas and gasoline engines to the Waukesha line... produced by Waukesha engine-builders and sold through the former Le Roi engine distributors... is of great importance to all users of internal combustion engine power.

The principal models of Le Roi gas and gasoline engines, formerly built by the Le Roi Division of the Westinghouse Airbrake Company, have been sold to the Waukesha Motor Company. The engines listed on the opposite page will be known as Waukesha "ROILINE" engines, and be built as bare engines, complete power units, and with components and accessories for special services.

Le Roi engines are widely used in the oil industry, and in various types of cotton ginning, compressor, generator, and pumping installations. They have been well-known in these fields and in other internal combustion engine applications for many years.

Waukesha has all rights to the manufacture and sale of these former Le Roi engine models and the service parts, patterns, and designs. Waukesha will produce the V-8 models H-540 and H-844 high speed transport and industrial engines in the Waukesha plant. The remainder of the engine models, including the in-line Six and large V-8 and V-12 engines, will be manufactured in Waukesha's Climax Division plant at Clinton, Iowa. ROILINE engines, parts, and service will be available in all sections of the country to owners, operators, and purchasers of these fine engines, through the ROILINE distributor organization. OEM accounts normally serviced directly by the manufacturer will be handled through the Waukesha headquarters sales office.

This expansion of Waukesha's production will enable Waukesha to manufacture and supply internal combustion engine power for any requirement from 6 to 1200 horsepower in all normal speed ranges and for use with all standard fuels.

• *The trade mark LE ROI is used under license from Westinghouse Airbrake Co., the trade mark owner.*

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SEE YOUR ROILINE DISTRIBUTOR

ARIZONA
Casa Grande
Engine Service Company

ARKANSAS
Paragould
Wonder State Manufacturing Co.

CALIFORNIA
Long Beach
Engine & Equipment Company

ILLINOIS
Centralia
John Nickell Company

LOUISIANA
Shreveport
Ingersoll Corporation

OHIO
Columbus
Cantwell Machinery Company

OKLAHOMA
Chickasha
Chickasha Gin & Mill Supply
Oklahoma City
Carson Machine & Supply Co.

PENNSYLVANIA
Pittsburgh
P. C. McKenzie Company

TEXAS
Houston
Southern Engine & Pump Co.
Lubbock
Farmers Supply Company
Odessa
General Machine & Supply Co.
Wichita Falls
Nortex Engine & Equipment Co.

UTAH
Salt Lake City
Transport Equipment Center

WYOMING
Casper
Emrick & Hill Engine & Equipt. Co.

Waukesha, Wisconsin • New York • Tulsa • Los Angeles

New DEMPSTER-
BIG-CAPACITY Containers

Slash Costs! Get More Than 40 YARDS Per Trip With These Giant "PORTABLE DUMPS"

Mfd. by Dempster Brothers, Inc.

See the driver pick it up WITHOUT LEAVING CAB!

1

2

DINOSAUR

End LONG-HAUL PROBLEMS

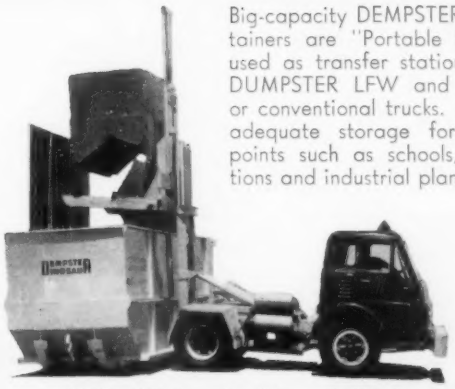
Up to 40 cubic yards and over . . . up to 30,000 pound loads . . . plus the advantages and economies of detachable containers . . . that's the story behind the all-new DEMPSTER-DINOSAUR. The safe, foolproof DINOSAUR is a masterpiece of simplicity . . . three simple, piston-type cylinders do the work . . . no cables to attach . . . no sheaves . . . no telescopic cylinders . . . maintenance and operational costs are slashed to the bone! It's the only machine of its type that picks up containers without the driver leaving his cab. The only one that can put containers on a dock.

3 simple cylinders do the work... NO CABLES!

3

Can Be Used As Transfer Station

Big-capacity DEMPSTER-DINOSAUR Containers are "Portable Dumps"...can be used as transfer stations for DEMPSTER-DUMPSTER LFW and GRD installations or conventional trucks. They also provide adequate storage for big-accumulation points such as schools, hospitals, institutions and industrial plants.



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KNOXVILLE 17, TENNESSEE

EQUIPMENT and MATERIALS

FOR YOUR

PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Sand, Chip and Calcium Chloride Spreader For Ice Control

429. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 509 No. Main, Fort Worth, Tex., or check the reply card.

Sealed Register Water Meter Contains 15 Stock Parts

445. A 20-page Catalog No. W-811, describing the Rockwell sealed register meter includes illustrations, drawings, specifications and color photos. Check the reply card or write Municipal and Utilities Division, Rockwell Manufacturing Company, 400 N. Lexington Avenue, Pittsburgh 8, Pa., today for complete parts list with illustrations and specifications.

Design Manual on Valve Remote Control Systems

451. This 20-page manual gives complete design data on Stow's flexible shaft valve controls including valve couplings and remote operating terminals. Check the reply card or write Stow Mfg. Co., 290 Shear St., Binghamton, N. Y.

Concrete Cutting Machine

454. A concrete cutter that has a front alignment pointer, hinged blade guard, 18 hp engine, right or left hand operation and control, uniform depth of cut is described in literature from Felker Mfg. Co., Torrance, Calif. Check the reply card.

Handbook on Condensation Drip and How NoDrip Can Cure It

457. This handbook gives valuable data on condensation and how the use of NoDrip will aid in preserving pipe and other metal equipment, by preventing rust and corrosion. Check the reply card or write J. W. Mortell Co., Kankakee, Ill., for your copy.

Tachograph for Recording RPM and MPH on Trucks and Buses

488. The Tachograph is a precision instrument that records on a chart the speed of a vehicle, rpm, distance traveled and running and idling or stopping of the engine. Check the reply card or write Automotive Div., Wagner Electric Corp., 6388 Plymouth Ave., St. Louis 14, Mo., for complete details.

New Concepts in Air Diffusion in Sewage Treatment

446. Bulletin 22-5-90 presents information on the theory of air diffusion and the various methods attempted to achieve optimum results. Check the reply card or write Walker Process Equipment Inc., 840 N. Russell Ave., Aurora, Ill., for operating data on the Sparjer Headers.

Gravimetric Feeders and Batch Weigh Plants

447. Syntron weigh-feeder equipment is covered in 12-page bulletin from Syntron Co, 660 Lexington Ave., Homer City, Pa. Check the reply card for data and specifications on feeders, weigh plants and weigh machines.

Decals for Trucks and Equipment

464. Decals permit wider latitude in design, brand all equipment the same and are easy, quick and inexpensive to apply. Write Ralph G. Mais, 14 Brooklyn Ave., Freeport, N. Y., or check the reply card for price list and how to order.

Continuous Loss-in-Weight Feeding Systems

466. Simplex or duplex gravimetric feeders for liquids or solids are covered in a 3-color bulletin released by Omega Machine Co., a division of B-I-F Industries, Inc., Providence, R. I. Check the reply card for dimensional drawings and tables, schematic drawings and performance charts.

Granite Traffic Control and Highway Safety Products

467. General specifications and details of granite curbing are covered in catalog from The North Carolina Granite Corp., Mount Airy, N. C. Described are vertical and sloped curbing, radius corners, bridge curbing and curb inlets. Check the reply card.

Automatic Valve Actuating Conversion Unit

469. Installed with only simple tools in 6 easy steps, the unit known as Valvmatic, converts hand-operated valves to motor operation. Check the reply card or write C. H. Wheeler Mfg. Co., 19th and Lehigh Ave., Philadelphia 32, Pa., for details on design, metallurgy and maximum pressure differential data.

Catalog on Floodlights, Airport Lighting Equipment and Traffic Control

471. This 12-page Bulletin 2706 describes the variety of equipment available from Crouse-Hinds Co., Syracuse 1, N. Y. Check the reply card for complete information.

Portable and Mobile AM Radiotelephone

480. Radiotelephone for public works departments are covered in literature from Kaar Engineering Corp., P. O. Box 1320, Palo Alto, Calif. Check the reply card for data on models and types.

Trenching, Loading and Dozing Machines

482. Complete ready-for-work units mounted on Case 34 and 42 hp utility tractors are described and illustrated in literature from J. I. Case Co., Racine, Wisc. Check the reply card.

Ottawa Truck-Mounted Backhoe For Chevrolet Trucks

486. Designed for complete mobility as well as digging ability, the unit travels at regular truck speeds and digs 12½ ft. deep in any position of a 190° arc. Check the reply card, or write Ottawa Steel Div. Young Spring and Wire Corp., Ottawa, Kansas.

MORE LISTINGS ON PAGES 39 TO 54

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Conveyor Chain Discharge on Ice Control Bodies

497. Baughman's spread-mobile and sand and cinder spreaders now feature a lubrication-impregnated drag chain discharge designed to resist corrosion of the automatic discharge system. Write Baughman Mfg. Co., Jerseyville, Ill., or check the reply card for full details on a complete line of ice control equipment.

Monotube Poles For Highway Lighting and Signing

509. This 24-page Catalog LS-23, describes steel and aluminum highway poles, overhead sign mountings and base and bracket details and is available from The Union Metal Mfg. Co., Canton 5, Ohio. Check the reply card today.

NEW LISTINGS (Cont.)

Hydraulic Mowers for Highway and Industrial Use

498. Tractor mounted mowers feature adjustable knife speed, instant change of cutting height and cutting angle and reversible motor for freeing jam-ups. Copies of the bulletin are available from A. C. Anderson, Inc., Dept. M-128, Wildwood, N. J., or check the reply card.

Automatic Blade Control For Caterpillar Graders

501. The Preco automatic blade control automatically holds the grader blade at the exact slope required, regardless of the position of the grader to the terrain. Check the reply card or write Preco Inc., 6300 E. Slauson Ave., Los Angeles 22, Calif., for complete data.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Incinerator Charging Gates

516. Incinerator charging gates for trash burning incinerators are described in a bulletin available from Allen-Sherman-Hoff Co., Dept. PW., 259 E. Lancaster Ave., Wynnewood, Pa. Check the reply card for features of design and construction and information on installation and operation.

Centralized and Remote Operations Control

517. How to control all elements of a water system from a single nerve center is described in fundamental terms and with illustrations in a 12-page bulletin. Application of Synchro-Scan to a multiple city installation, how telemetering works, what basic elements are required, and how telemetering can keep pace with expansion plans, are all carefully shown. Write for Bulletin 240-P2A from Builders-Providence, Inc., Providence 1, R. I., or check the reply card.

Use The Reply Card

Complete Ice and Snow Fighting Equipment

523. Snow plows in 55 models and 9 types, material spreaders with width of spread of 8 to 20 ft. and hopper capacity of 2 cu. ft., and truck grader ice blades are covered in literature from Wausau Iron Works, Wausau, Wisc. Check the reply card.

Calcium Chloride For 2-Way Highway Ice Control

526. For data on the use of calcium chloride in ice control write Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y. Check the reply card for full details.

Lift or Lower Snow Plows Automatically

531. Battery operated or fan-belt driven hydraulic controls that lift or lower snow plows are described in literature from Monarch Road Machinery Co., 1331 Michigan St., N. E., Grand Rapids 3, Mich. Check the reply card.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models, are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Badger Read-o-Matic Register For Outside Water Meter Reading

536. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Water Meters, 4545 West Brown Deer Road, Milwaukee 18, Wisc.

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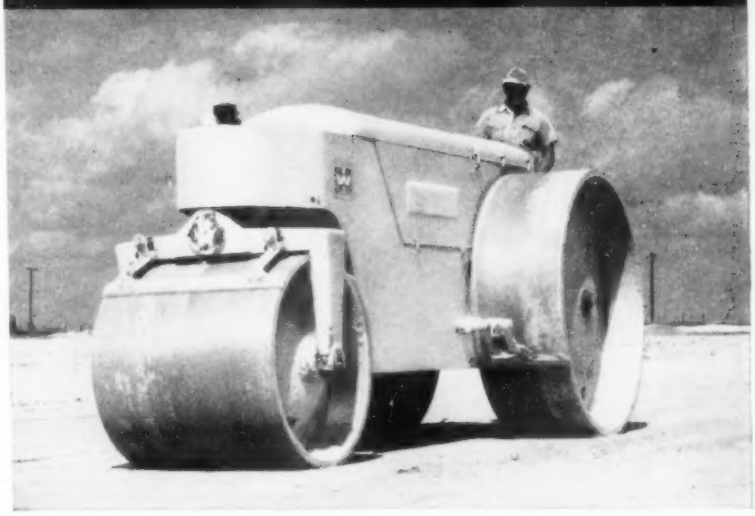
3-Wheel rollers



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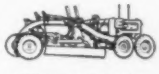
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HUBER WARCO

To order these helpful booklets check the reply card opposite page 40.

NEW LISTINGS (Cont.)

Equipment For the Testing of Soils, Concrete and Bituminous Materials

541. This 130-page catalog covers soils—field and in situ, drilling and sampling, soils laboratory, general apparatus and accessory equipment, concrete and bituminous Check the reply card or write TESTlab Corp., 250 W. 57th St., New York 19, N. Y., for a copy of this valuable catalog.

Protective Clothing For Public Works Departments

542. Eight-page catalog illustrates and describes work suits, raincoats, storm suits, gloves and aprons. Charts make it easy to select garments according to weight, service, color and material—rubber, Koroseal, neoprene and Hycar. Check the reply card or write Public Relations, B. F. Goodrich Industrial Products Co., Akron, Ohio.

Refractory Brick and Other Shapes

544. This 24-page catalog has been written to aid design engineers and operators select the proper refractory products for municipal incinerators. Write Publicity Dept., Norton Co., Worcester 6, Mass., or check the reply card for this technical data.

Rockwell Standard Flanged Butterfly Valves

545. Design, physical and chemical characteristics of materials, construction and testing of W. S. Rockwell butterfly valves are described in Bulletin No. 581 available from W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn. Check the reply card.

Traveling Water Screens

548. Rex traveling water screens provides maximum capacity, positive sealing, rugged design, positive debris removal from screen, long life and design flexibility. Check the reply card for engineering data or write Chain Belt Co., Milwaukee 1, Wisc., today.

Cushioned Swing Check Valve

552. The rubber or Saran lined cushioned check valve is covered in Bulletin W-11 available from the Golden Anderson Valve Specialty Co., 1232 Ridge Ave., Pittsburgh 33, Pa. Check the reply card for specifications.

Manual on Solving Drainage Problems

554. A 74-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for this valuable book.

•

WATER WORKS

Meters and Instruments For Water Works

43. An attractively arranged 20-page booklet issued by Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif. furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use reference. Requests for this valuable publication should be accompanied by your business letterhead.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves.

Engineering Data on Screening Equipment

77. Water, sewage and industrial waste screening equipment is fully described in a 28-page book, No. 2587, offered by Link-Belt Co., Colmar, Pa. Complete data for the engineer and tables to determine the proper size unit for handling various capacities are included. This valuable comprehensive booklet may be obtained by checking the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

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Lake Placid, N. Y., Sept. 10-12

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Atlanta, Ga., Sept. 10-12

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International Congress on Large Dams
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Deadwood, S. Dak., Sept. 17-19

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Chicago, Ill., Sept. 21-25

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Kansas City, Mo., Sept. 28-Oct. 1

National Highway Conference for County Engineers and Officials
Kiamesha, N. Y., Sept. 29-Oct. 1

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Boston, Mass., Oct. 5-8

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Detroit, Mich., Oct. 5-9

17th Annual Ohio Short Course on Roadside Development
Columbus, Ohio, Oct. 7-10

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New York, N. Y., Oct. 13-17

American Bridge, Tunnel and Turnpike Ass'n.
Richmond, Va., Oct. 15-18

International City Managers Ass'n.
Dallas, Texas, Oct. 19-23

41st Annual Meeting National Slag Ass'n.
Washington, D. C., Oct. 21-22

Virginia Highway Conference
Lexington, Va., Oct. 23-24

World Meeting of International Road Federation
Mexico City, Mexico, Oct. 26-31

California Section, AWWA
Los Angeles, Calif., Oct. 28-31

Institute of Traffic Engineers
Miami Beach, Fla., Nov. 11-13

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Elevated Tanks and
Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Plastic Wash Troughs
For Water Treatment

45. Leopold fiberglass-reinforced plastic wash troughs for water treatment are described in literature from F. B. Leopold Co., Zelienople, Pa. Check the reply card for data on these units that will last for years without any painting or other maintenance.

Rapid Sand and
Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Engineering Data on
Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Engineering Data
On Gravity Filter Design

170. The complete line of gravity filters and related accessories furnished by the Permutit Co., a Division of Pfaudler-Permutit, Inc., New York 36, N. Y., is covered in a well-illustrated 24-page booklet. Each element of a filter and filter controls are discussed in detail to assist the designer of these important units. Check the reply card.

Mueller Copper
Water Meter Yokes

242. Copper meter yoke provides a tailor-made setting with fewer joints and fittings and it permits the installation of service lines without placing the meter. Check the reply card or write Mueller Co., Decatur, Ill., for complete information.

Chapman
Standard Sluice Gates

276. Manual, hydraulic or electric motor control sluice gates are described fully in Catalog 25 available from The Chapman Valve Mfg. Co., Indian Orchard, Mass. These valves are easy to replace and are fitted without alterations. Check the reply card.

Clow Bell-Tite
Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Davis Back-Hoe
and Davis Loader

312. Literature is available from Massey-Ferguson Industrial Division, Massey-Harris-Ferguson, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Renew Pipe Performance
With Cement Mortar Lining

322. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.

Points to Consider
in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

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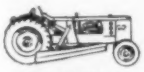
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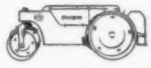
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Valuable Bulletin on Rodney Hunt Sluice Gate

61. Sluice gate seats on a resilient rubber seal flush with the bottom of the channel and eliminates bottom wedges and the trough in which they descend. Gives design flexibility in water filtration, sewage treatment and sluices, dam, channel and chamber flow control. For complete details write to Rodney Hunt Machine Co., 82 Lake Street, Orange, Mass. for Bulletin 75, or check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 7 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-jointed installations, and suggestions to assist engineer in specifying Tylox joints for both tongue and groove, and bell and spigot pipe. Check the reply card.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

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Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card.

Technical Bulletin on Swimming Pool Filtration Equipment

335. A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included. Use the reply card for your request.

Convertible ½-yd. Hydrohoe, Hydroshovel and Hydrocrane

338. The Bucyrus-Erie H-5 Hydrohoe combines high production with mobility and flexibility. Check the reply card or write Bucyrus-Erie Co., South Milwaukee, Wisc., for details on this unit that can be converted to a crane, clamshell, backhoe and shovel.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Automatic Bin Level Indicators For All Bulk Materials

378. Bin level indicators for municipal water treatment, asphalt batching plants, concrete batch plants and other installations where bins are used are described in 20-page catalog from the Bin-Dicator Co., 13946 Kercheval Ave., Detroit 15, Mich. Check the reply card.

What You Should Know About Hypochlorination

395. "Hypochlorination of Water" is the name of an informative publication issued by Olin Mathieson Chemical Corp., Industrial Chemicals Div., Baltimore 3, Md. In it there is a discussion of chlorination theory, practice and equipment; control of algae, tastes and odors; and laboratory testing.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

Ditcher for Water Pipe Laying

426. A vertical boom, crawler ditcher is described in literature available from Barber-Greene, 400 No. Highland Ave., Aurora, Ill. Specifications and models are fully covered. Check the reply card.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

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CYCLOMATIC PACKING ON THE NEW LOAD-PACKER 500 SPEEDS COLLECTIONS ...PERMITS FASTER SCHEDULING!

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Put the Load-Packer 500 to work in your collection system. Contact your Gar Wood - St. Paul truck equipment distributor. Or, write to Customer Service Dept., Gar Wood Industries, Inc., Wayne, Michigan.

New Gar Wood Pax-All Refuse Containers snap quickly on and off without use of chains or cables. Complete hydraulic operation is controlled with one lever. Simple yet rugged design stands up under day-in, day-out use.

GarWood INDUSTRIES, INC.
Wayne, Michigan • Richmond, California

To order these helpful booklets check the reply card opposite page 40.

What You Should Know About the Rubber Waterstop

448. A bulletin on the Servicised rubber waterstop has been released by Servicised Products Corp., 6051 West 65th St., Chicago 38, Ill. General information, engineering service, advantages of specifying the waterstop, specifications, general and detail requirements, installation and typical applications, standard sizes and types are fully covered.

Copper Sulfate In Control of Microscopic Organisms

529. This valuable 52-page manual on the use of copper sulfate in the control of microscopic organisms in water supplies is available from Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y. Covered are organisms, odors, methods of using copper sulfate, calculation tables and table showing chemicals required for treatment of different Genera.

Manual on Valves, Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Data on Mechanical Joint Tapping Valves and Sleeves

605. Eddy mechanical joint tapping valves and sleeves are described in literature available from Eddy Valve. Also described are repair sleeves for cast iron and asbestos cement water mains. Write Eddy Valve Company, Waterford, New York, or circle the reply card for your copy.

Fluo-Chlorinator For Fluoridation and Chlorination

695. Catalog 70F140 describes the Fluo-Chlorinator which adds controllable quantities of fluoride and chlorine solution to potable water supplies and it is available from Fischer & Porter Co., 36 Jacksonville Road, Hatboro, Pa. Check the reply card for operation, installation and maintenance information.

Slide Rule For Chemical Feed Calculations

627. A very handy chemical feed calculator is available from Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. Pounds per million gallons, grains per gallon and grains per gallon of CaO from lime are several of the calculations that can be made. Check the reply card today.

Calgon TG For Better Corrosion Control in Water Systems

780. Calgon Composition TG is a sodium-zinc hexametaphosphate corrosion inhibitor for municipal water systems. Bulletin 420-12-9 is available from Calgon Co., Hagan Chemicals & Controls, Inc., Hagan Bldg., Pittsburgh 30, Pa., or by checking the reply card.

●

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N.J. Check the reply card and we will forward your request.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Right Angle Gear Drive For Centrifugal Pumps

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Flush Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Bituminized Fibre Pipe For Sewer Connections

172. Bermico pipe for house to sewer or house to septic tank connections is described in literature from Brown Co., 150 Causeway St., Boston 14, Mass. Check the reply card for full details.

Manual on Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

How Mud-Jack® corrects sunken slabs

Want an easy, low-cost way to raise settled sidewalks, street slabs, curbs, gutters, driveway approaches? Check Koehring® Mud-Jack. It pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water or water saturated materials — *raises the concrete slab* — leaves firm permanent sub-grade. Two sizes available: A small portable Mud-Jack for cities, a larger model for maintenance, low-cost repairs on highways.

KOEHRING DIV., Milwaukee 16, Wis. *Send us new Mud-Jack catalog*

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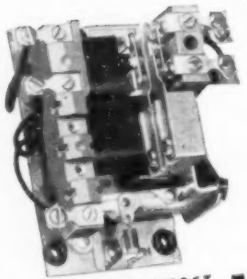
STREET .....

CITY, STATE ..... K806 PW



• Catalog also covers Induction Relays, Relay Enclosures, Contactors and Starters, Multiple Pump Controls, Electrode Holders, Starter and Relay Combinations, Special Controls and Panels.

B/W CONTROLLER CORPORATION
2224 E. Maple Road
Birmingham, Mich.

FIRST and FOREMOST IN THE FLOATLESS CONTROL FIELD

2

The 544 loads snow at 7-11 cu. yd. per min. Or loads coal or leaves . . . or converts to the lowest-cost way to load aggregate from stockpile to truck. A 15 m.p.h. road speed and a hydraulic truck trimming conveyor boost speed and efficiency on any job.

Snow loaders that pay off all year 'round

Big snows are costly. Traffic gets jammed . . . fire trucks and police cars are blocked . . . business drops off. Time and money are lost.

But snow removal is costly. For most cities and towns it's too costly to maintain single-purpose snow removal equipment.

Barber-Greene multipurpose loaders solve this problem neatly and economically. As snow loaders, these machines have the high capacity and easy maneuverability to open up snowbound communities in a hurry. Between snow seasons, these versatile Barber-Greenes handle coal or easily convert to leaf and aggregate loaders to extend their efficiency to a year-round basis.

The 550 loads snow at 6 cu. yd. per min. As a windrow loader, its capacity is 4 cu. yd. per min., which keeps it ahead of all trucks normally available. Highly maneuverable, with a 10 m.p.h. road speed and a turning radius of only 8'6".

Write for details on these all-season loaders today.

56-24-L

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

To order these helpful booklets check the reply card opposite page 40.

Dorr-Oliver CompleTreator For Small Sewage Plants

266. An 8-page, 2-color bulletin that describes the Dorr-Oliver CompleTreator is available from Dorr-Oliver Inc., Stamford, Conn. Check the reply card for line drawings, flow diagrams and a series of photographs showing the step-by-step installation of the unit.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

Device Used to Regulate Flows of Liquids

396. Valuable data on details of design, capacities, dimensions and typical installations of the Simplex Type S Controller are covered in literature from Simplex Valve & Meter Co., 7 East Orange St., Lancaster, Pa. The unit regulates flow of liquids in filter plants and is used to maintain a uniform rate of filtration through each filter unit. Check the reply card.

Filter Sands and Under Drain Gravels

415. Filter sands and gravels for municipal water plants are described in literature available from Eau Claire Sand & Gravel Co., Eau Claire, Wis. Check the reply card for data on sizes available, silica content and content of magnesium, calcium carbonates and iron oxides.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Dependable Engines for Sewage Treatment Plants

227. Climax Sewage Gas Engines are available for continuous duty operation to drive pumps, blowers or generators in a range of sizes from 40 to 250 HP. Use the handy reply card to obtain complete details and literature from Climax Division, Waukesha Motor Co., Box 379, Waukesha, Wisc.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

V-Notch Chlorinators For Water and Sewage Plants

590. Bulletins on the Series A-711 and the Series A-712 chlorinators are available from Wallace & Tiernan Inc., Box 178, Newark N. J. Covered in the literature are design features that include operation, installation and maintenance. Simplified flow diagrams in color are included showing the operation of the units. Class, capacities, feed ranges and electrical requirements are described in the technical data section. For your copies, check the reply card.

Portable, Standby Or Continuous Power

440. Generators and power plants for emergency, portable continuous power are described fully in literature available from Katolight Corporation, Box 89-107, Mankato, Minnesota. Information on motor generator sets, high frequency changers and independent generators up to 400 K. W. is included.

Vitrified Clay Floor System For Trickling Filters

452. The IMCO two unit floor is noted for its mechanical strength, simplicity of construction and large percentage openings for aeration. The units are self spacing and easily set in place. Check the reply card or write Industrial Materials Co., Somerset St. and Trenton Ave., Philadelphia 34, Pa., for complete catalog.

Controls For Use in Pumping Stations and Sewage Plants

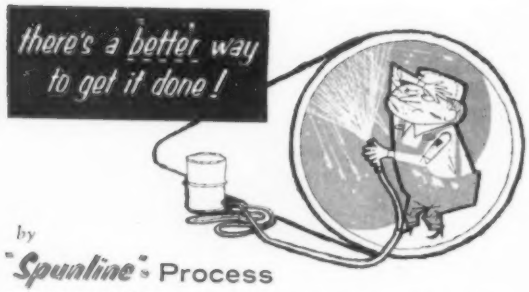
662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527 available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.



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Centrifugally rotating head of Spunline applicator provides uninterrupted continuity.

Newly developed Spunline Process... a combination of the world famous Tate and centrifugal processes... is now available for cement mortar lining of 6" to 16" diameter pipes "in place." Permits application of thinner lining with closer tolerance... permits lining past smaller openings and corporation stops... through many bends and certain fittings. Particularly advantageous with cast iron pipe... restores flow coefficients, protects against corrosion, contamination. *Write today for full information.*

Specializing in Pipe Protection Problems - Tate, Centriline, Spunline "In Place" Interior Cement Mortar Lining - "In Plant" and "Railhead" Centrifugal Spinning of Cement Mortar or Coal Tar Linings - Somastic® Exterior Coating - Pipe Wrapping - Reclamation - Removal of Old Wrapping, Straightening, Blasting, Beveling, Testing

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Wilmington, California

GOOD ROADS "CHAMPION" SNOW PLOWS

REVERSIBLE • ONE-WAY • V-PLOWS • RIGID PLOWS

Good Roads Snow Plows perform smoothly and efficiently under the most adverse snow removal conditions. These rugged, heavy-duty plows are engineered to provide safe, speedy snow removal on highways, roads, streets, parking lots and airports.

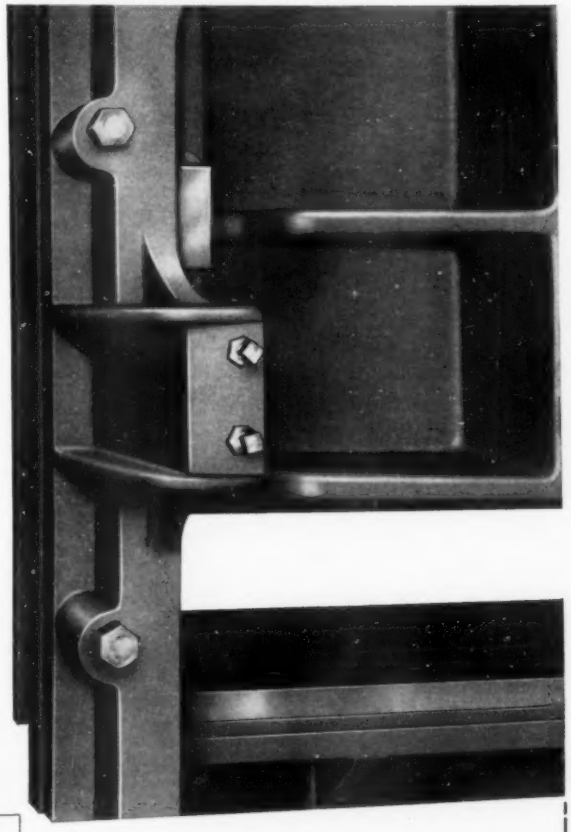
Model 100 Reversible and 700 One-Way Plows are equipped with the exclusive Good Roads spring-cushioned, safety-blade trip device with automatic return for safe plowing at high speeds, protecting men and equipment.

For further information on models available, write:

Good Roads MACHINERY — **GOOD ROADS MACHINERY Corp.**
MINERVA, OHIO

Armco Gates with flush bottom openings give you increased capacity, flushing action, uninterrupted flow

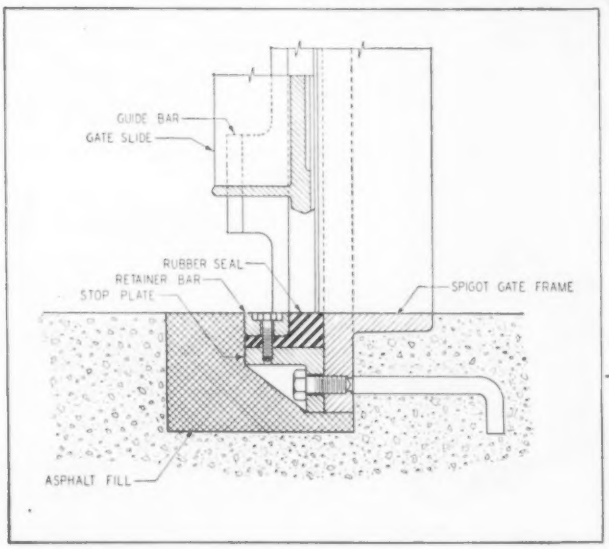
Close-up view of Armco flush bottom opening.



Flush bottom openings in various Armco Gates provide a continuous flat bottom channel across the bottom of the gate opening. There are no protrusions to interfere with flow or to catch debris and solids when the gate is open. Since only the top surface of the rubber seal is exposed, these openings are equally efficient for flow or operating heads in either direction. You can get the flush bottom opening on all sizes of Armco Series 35-05, 55-10, 55-20, and 100-30 Gates (more than 200 different gates).

Armco Gates are also available with standard perimeter seating. Sizes range from 6-inch square or circular openings to 108 inches. They are available for face heads up to 100 feet, back heads up to 30 feet.

Send coupon for folder, "Armco Gates for efficient, trouble-free water and sewage control." Armco Drainage & Metal Products, Inc., 3058 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.



Armco Drainage & Metal Products, Inc.,
3058 Curtis Street, Middletown, Ohio

Send me the folder, "Armco Gates for efficient, trouble-free water and sewage control." I am interested in Armco Gates for the following uses

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City _____ Zone ___ State _____

ARMCO GATES

To order these helpful booklets check the reply card opposite page 40.

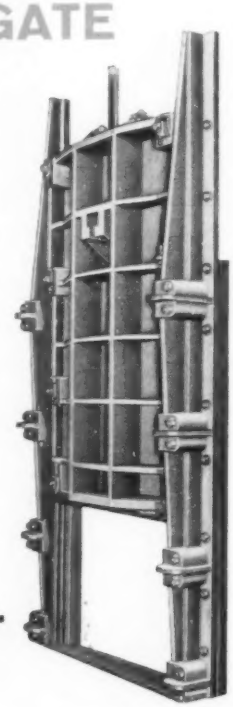
For construction economy...

Rodney Hunt HY-Q Flush Bottom Closure Sluice Gates offer exclusive design advantages which frequently result in substantial savings. Unlike any other design, the Rodney Hunt HY-Q gate seats on a sill flush with the invert, providing greatly improved flow characteristics over conventional gates. This in turn permits the use of a smaller gate size, a narrower channel and lower channel walls to handle a given volume of flow . . . and reduced construction costs.

HY-Q SLUICE GATE

The first basic sluice gate improvement in years features a resilient seal fastened to the bottom of the sliding disc to provide a cushioned closing at the stop bar. This flush bottom closure assures full, fast, non-turbulent flow at maximum hydraulic gradient, unobstructed by silt or debris. It permits complete drainage of the channel without pumps or piping. In brief, it offers unmatched design flexibility for water, sewage treatment and similar projects . . . with more than 80 gate sizes available, ranging from 12" x 12" to 190" x 120".

For full design and specification data, write for your copy of Catalog 75.



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RODNEY HUNT MACHINE CO.

Water Control Equipment Division
82 Water Street, Orange, Mass., U. S. A.

Serving water control engineers with equipment and engineering

SNOW AND ICE CONTROL

Get Full Data On Aggregate Spreaders

34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safer-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Full Line of Weapons for Snow and Ice Battles

268. Whether your snow problems are heavy or light, you'll find equipment for virtually all your needs among the plows and spreaders offered by Good Roads Machinery Corp., Minerva, Ohio. The "Champion Line" of Vee plows and one way and reversible plows with safety blade trip will handle snow removal; for chlorides and abrasives spreading there are five "Jet Line" spreader models and the 4-U towed spreader.

Reversible and Roll-Over Type Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, New York.

Catalog on Equipment For Ice and Snow Control

410. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co, Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Ice Control Without Corrosion Dangers

439. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa.

How to Make Icy Surfaces Safe

455. A bulletin on how calcium chloride works in ice control and directions for its use has been made available by Wyandotte Chemicals Corp., Wyandotte, Michigan. Other uses of calcium chloride are fully outlined.

Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

NEW

TL-16 TRACTOLOADER®

Engine: diesel, 97 hp
Weight: 15,800 lb
Buckets: 1½ to 3½ cu yd

ALL THE EXCLUSIVE FEATURES THAT MAKE THE TL-20 SO POPULAR ARE INCORPORATED IN THE NEW TL-16.

STRONGER AXLE CONNECTION Axles are connected directly to frame with 2-inch diameter steel pins. No rolling and shifting under load!

DUMP CYLINDERS AWAY FROM DIRT Mounted high up and well back on loader . . . away from bucket, away from trouble.

EXTRA STABILITY WITH LONGER WHEELBASE No loss of power and traction getting loads . . . no tipping and spilling traveling with loads.

LONGER REACH Fast, even dumping because there is extra reach — no time wasted leveling load. Long booms available for special loading work.

EXTRA HYDRAULIC PROTECTION Air is double-filtered. Oil is cleaned by a full-flow filter PLUS magnetic and conical screen filters.

OTHER WORKING ADVANTAGES INCLUDE:

Hydraulic Torque Converter Drive • Tip-Back Bucket Power Steering • 4-Wheel Drive • 4-Wheel Power Brakes • "Hi-Traction" Differentials • 4-Way Adjustable Seat • Rear-Axle Disconnect • Bucket Position Indicator

Another Big TRACTOLOADER® with Tractomotive's *Exclusive* Operating Simplicity . . .

SINGLE LEVER SPEED AND DIRECTION CONTROL.
Operator "power-shifts" into *any* forward or reverse gear "on the go" with one lever. There's no speed-range lever or any other shift lever to slow him up! Time saved is yardage gained.

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Address .....
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To order these helpful booklets check the reply card opposite page 40.

STREETS AND HIGHWAYS

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks, streets and factory floors solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a 16 page catalog by Koehring Division, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy reply card for full data. Ernest Holmes Co., Chattanooga, Tenn.

Graders With Torque Converters and Power Shift Transmissions

142. Described in Bulletin No. HWG-508 is the Huber-Warco 50-190, 195 hp grader. Features include power sliding moldboard, easy to reach controls, four-wheel brakes and retractable scarifier. Write Huber-Warco Co., Marion, Ohio, or check the reply card.

Ultra-Clean Sweeping For Streets, Yards and Airports

499. A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

Core Drills and Soil Sampling Equipment

188. Diamond drill machines, Oriented diamond bits, soil sampling equipment and core drilling accessory equipment are fully covered in well illustrated catalog from Sprague & Henwood, Inc., Scranton 2, Pa. Check the reply card.

Catalog on Transits, Levels and Surveying Equipment

435. Warren-Knight field equipment for surveying is covered in a 26-page well illustrated catalog. Specifications, models and prices are included. Check the reply card or write Warren-Knight, 136 North 12th St., Philadelphia.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

For Prompt Service Use The Reply Card

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Crezon Plywood Signs Have Long Life Expectancy

641. Crezon overlaid plywood signs are described fully in literature available from Crown Zellerbach, San Francisco 19, Calif. Material is strong and rigid, resists bending or tearing loose from the pole and there's neither checking nor blistering from heat or freezes.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Rubberized Playground Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Reflective Pavement Marking

685. Centerlite reflective compound has the beads already in the mixture and you apply the stripe in one pass on the pavement. Check the reply card or write Minnesota Mining & Mfg. Co., Dept. QV-28, St. Paul 6, Minn., for full details.

Overlaid Plywood For Highway Signs

764. Highway signs that are made of overlaid plywood that will not bend, crack or rust are described in literature from Simpson Logging Co., 2301 N. Columbia Blvd., Portland 17, Oregon. Check the reply card for data on both medium and high density plywoods.

clearing a path across the U.S.A.!

You may be clearing brush for rights-of-way from the Gulf of Mexico to the Canadian border; you may be a highway commissioner faced with equally important problems of brush and weed control from Virginia to Oregon.

In any case, your Diamond agricultural chemicals specialist will study your situation and recommend the *one* brush and weed control formulation best suited to your specific needs.

Diamond has long specialized in individual brush killer and herbicide formulations for large volume users. This experience can work for you to cut your costs and give you a more effective control—whether you use your own spraying equipment or hire custom sprayers.

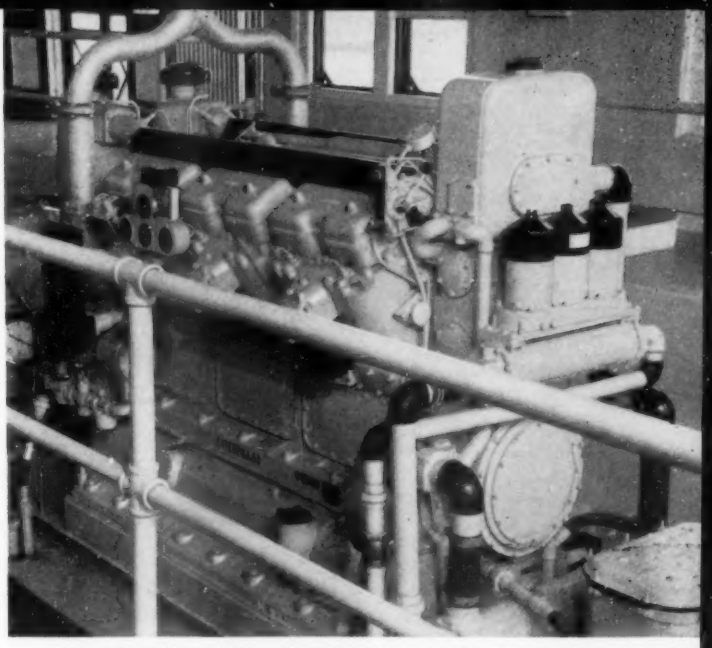
Write today for complete information. Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

DIAMOND FORMULATIONS:

Technicals 2,4-D and 2,4,5-T (Acids & Esters)
Emulsifiable Concentrates 2,4-D and 2,4,5-T (Amines & Esters)
Line Rider, Fence Rider, Crop Rider Formulations
Custom Formulations

Diamond Chemicals

From foundation up, CAT Diesels are modern heavy-duty engines!



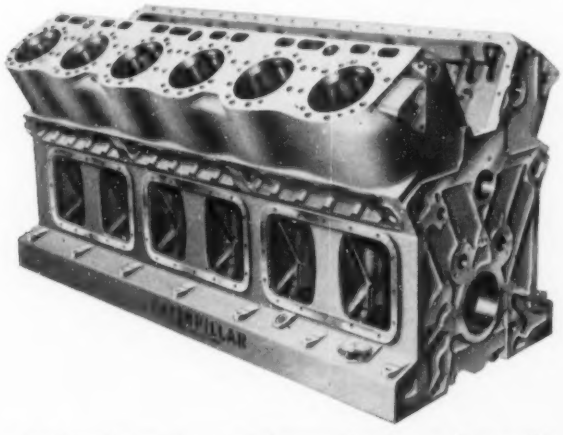
City of Wildwood Pumping Station, Rio Grande, New Jersey, relies on this Cat Engine (327 HP output) to furnish all power for water pumpage. The station serves Wildwood, Wildwood Crest, Rio Grande and adjacent communities. The Caterpillar Engine pumps from 5 to 7 million gallons rate of water per 20-hour day, 7 days a week, during the summer.

In more than a quarter century of diesel leadership, Caterpillar has pioneered advance after major advance into its great engines. From foundation up, they incorporate the latest developments of design and manufacturing techniques. As a result, on installation after installation, they have established outstanding records for economy, dependability and long life. Cat Engines are available up to 650 HP (maximum output capacity)—Electric Sets up to 350 KW (continuous duty). They are honestly rated and certified for capacity. Let your Caterpillar Dealer, a power expert, help you select the unit that meets your needs most economically and efficiently!

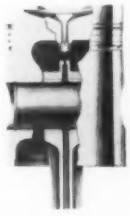
Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

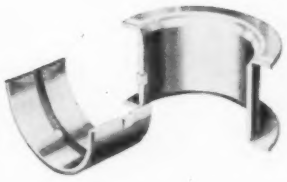
ENGINE POWER BY CATERPILLAR



A firm foundation. Strong, rigid support for all parts of Caterpillar Engines is provided by a unit-cast crankcase and cylinder block. Internal walls give extra support for the bearings and add rigidity to the block. Careful control, modern processing and rigid inspection in Caterpillar's own foundry insure a perfect foundation for every Cat Engine.



Heavy-duty pistons. Pistons in Caterpillar Engines combine the light weight of aluminum, the durability of cast iron, the heat resistance of stainless steel and the wear resistance of chromium. All add up to savings for you through a long life of efficient operation with low maintenance costs.



Steel-backed bearings. Steel-backed aluminum bearings are the finest available. Proof: Many Cat Engines have operated for more than 20,000 hours and are still using their original bearings. Chief reason for their long life is their ability to resist acids normally found in engine crankcases.

Dept. PW8, Engine Division

CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

Send me more information about Caterpillar Diesel Engines. I have checked the proper box to guide your selection of material.

☐ I would like detailed information, as I may be in the market for a Cat Diesel Engine or Electric Set. I understand that I am under no obligation.

☐ I am interested in learning more about these units.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

To order these helpful booklets check the reply card opposite page 40.

CONSTRUCTION EQUIPMENT AND MATERIALS

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penndrill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Check List for Successful Earthmoving Bids

147. Valuable information for the earthmoving contractor and for the engineer who must estimate earthmoving costs is provided in a new two-color illustrated booklet issued by Caterpillar Tractor Co., Peoria, Ill. A convenient check list is included to help select the proper equipment for the job. Check the reply card to get Form No. DE502.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

International 6-Cylinder Carbureted Power Units

398. A graphically-illustrated 12-page catalog CR-511-G, on IHC 6 new 6-cylinder power units is available. Power and fuel consumption curves and cutaway views of component parts of the units are covered Check the reply card or write Construction Equipment Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., for specifications.

Light Duty Trucks For Construction and Maintenance

628. Pickup and stake body trucks are fully described in literature from Ford Div., of Ford Motor Co., Dearborn, Mich. Pickups are available in 6½, 8 and 9-ft. lengths. They come in standard colors and with either a 6 or V-8 engine. Rigid tailgate and steel corner posts add to the over-all body strength. The stake body trucks come in 6½, 7½ and 9-ft lengths. These units also come in 6 or V-8 engines. Check the reply card for full information.

Handbook on Selecting Power For Pumping

694. A 12-page power selection handbook, "Selecting Power For Pumping," has been released by the Advertising Div., Caterpillar Tractor Co., Peoria, Ill. This handbook is especially useful to those who have a pumping operation. It contains a checklist of features necessary for continued dependable operation on pumping jobs. List describes the proper requirements which an engine must have, backing them with illustrations and examples of efficient installations. Check the reply card today.

Drilling Machine For Concrete

221. The Truco diamond drilling machine is described in literature available from Truco Swivel Div., Wheel Trueing Tool Co., 15-3200 W. Davison Ave., Detroit 38, Mich. Unit will cut reinforced or plain concrete. Check the reply card.

4-Wheel Drive Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit described in literature available from the Badger Division of Warner & Swasey Co., Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

Agent For Improving Adhesion Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Slide Rule PS1 Calculator For Concrete

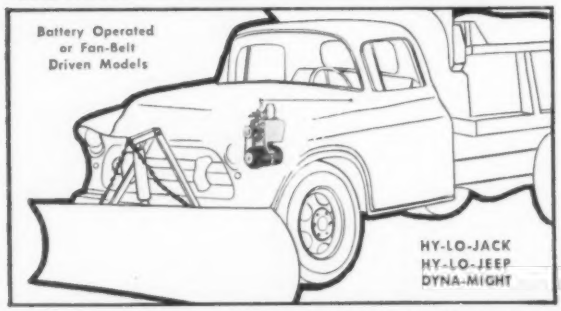
713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

LIFT SNOW PLOWS ...automatically

Lift or lower your snow plow automatically! One man operates the plow right from the truck or jeep cab. Instant action! Snow removal is easier, faster, more efficient. See your dealer or write for full information.

MONARCH CONTROLS

MONARCH POWER HYDRAULIC CONTROLS



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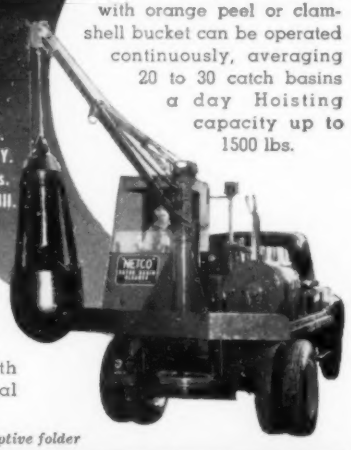
Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clam-shell bucket can be operated continuously, averaging 20 to 30 catch basins a day Hoisting capacity up to 1500 lbs.



NETCO does almost three times as many basins a day at less than half the cost per basin compared with old-fashioned manual methods.

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NETCO DIVISION
CLARK-WILCOX COMPANY
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McConnaughay WEATHER-PROOF EMULSIFIED ASPHALTS

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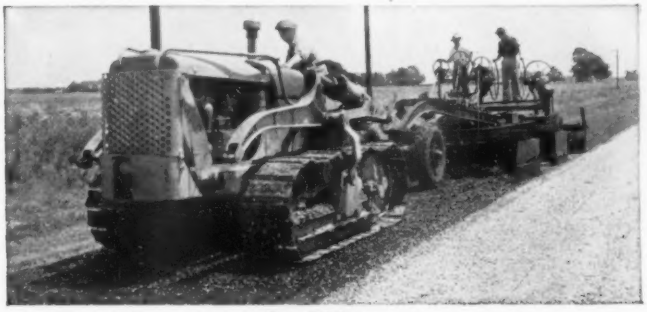
Application Types

Special Uses



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EMULSIFIED ASPHALT *PLANTS AND PROCESSES*

To order these helpful booklets check the reply card opposite page 40.

STREET LIGHTING AND TRAFFIC CONTROL

Get Full Data On the Radar Speed Meter

22. Accurate readings of vehicle speeds, with direct indications in miles per hour and a graphic recorder for permanent record are available by use of the Electro-Matic Radar speed meter, a product of Automatic Signal Division, Eastern Industries Inc., Norwalk, Conn.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote, Corp., P. O. Box 2066, Jackson, Miss.

Highway Lighting Engineering Guide

207. This catalog is primarily aimed at the new highway lighting program that is being undertaken nationally. It gives data on the quantity of light required: lighting on main traffic lanes, interchanges, intersections, toll plazas and bridges. It also covers information on the relative cost of lighting and the selecting of the light source. Write to Westinghouse Electric Corp., Lighting Div., 1216 West 58th St., P. O. Drawer 5817, Cleveland, Ohio.

Aluminum Lighting Standard Catalog

768. This 16-page catalog contains complete engineering data and illustrations of the various types, sizes, weights and spans of lighting standards. Check the reply card or write Kerrigan Iron Works, Inc., Nashville 2, Tenn., for this valuable catalog.

REFUSE COLLECTION AND DISPOSAL

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a soluition, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Data on Refuse Collection Bodies

615. The Hydro E-Z Pack compacting unit has only 2 working parts—a high volume roller bearing pump and a double-acting telescopic cylinder. A refuse-crushing compacting pressure of 82,500 lbs. is attained in the units. Write Hydro E-Z Pack Co., Galion, O., or check the reply card for complete specifications.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis. Check the reply card today.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

WEED AND DUST CONTROL

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

TRUCO® DOES IT AGAIN!!!

KING SIZE HOLES in 30" reinforced concrete footing drilled with TRUCO MACHINE and TRUCO DIAMOND BITS

JOB: Cut 87 holes 3" diameter around three 30" diameter circles through 30" reinforced concrete footing of a 50' retaining wall; holes to be cut without impact or vibration which might shatter concrete, break bond of concrete to 1¼" steel rods, or cause spalling which would expose reinforcement. Purpose of the holes was to permit pouring of three 24" diameter by 46' friction piles to support a reinforced concrete plate upon which would be erected a 70' concrete and ceramic pylon weighing 200 tons.

PROJECT: Fort Moore Pioneer Memorial, Los Angeles.

CONTRACTOR: John L. Meek Construction Co. Inc., L. A.

TOOLS: Truco Model B Portable Diamond Drilling Machine, 750 rpm motor, 3" O.D. Truco Diamond Drill Bits.

OPERATION: Truco machine was set up and anchored to bolts in footing so it could be rotated in a circle. Anchoring provided leverage for fast cutting. Drilling 29 overlapping holes around a circle provided a 30" diameter hole with a 27" core weighing over a ton. Bits pierced concrete and steel without difficulty. Each 30" x 30" hole was completed in 29 hours. Nine Truco bits were used.

Write or phone for nearest distributor's name.

TRUCO MASONRY DRILLING DIVISION
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LACLEDE WELDED WIRE FABRIC holds resurfacing jobs in place

St. Louis County's Brentwood Boulevard gets rugged treatment from the constant parade of cars, trucks and buses. But Laclede's welded wire fabric helps this new resurfacing job weather the barrage of wheels.

Laclede's welded wire fabric holds the resurfacing material securely . . . reinforces it against creep and surface deterioration. Even at bus stops the movement and gouging of the pavement is minimized.

CONTRACTOR:
Kelly Bros. Contracting Company
St. Louis County, Missouri

USE THESE LACLEDE HIGHWAY STEELS FOR REPAIR WORK . . . AND FOR NEW CONSTRUCTION

welded wire fabric
welded dowel spacers
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PUBLIC WORKS CONGRESS AND *Equipment Show*

September 28 - October 1, 1958

We are highly honored to have the APWA hold its 1958 Public Works Congress and Equipment Show in Kansas City. The Local Committee, together with the officers and staff of our Association, is going all-out to make this a very worthwhile meeting for all persons concerned with public works activities.

Plan now to attend. We will certainly look forward to seeing you and assure you that everything will be done to make your trip a very profitable and enjoyable experience.

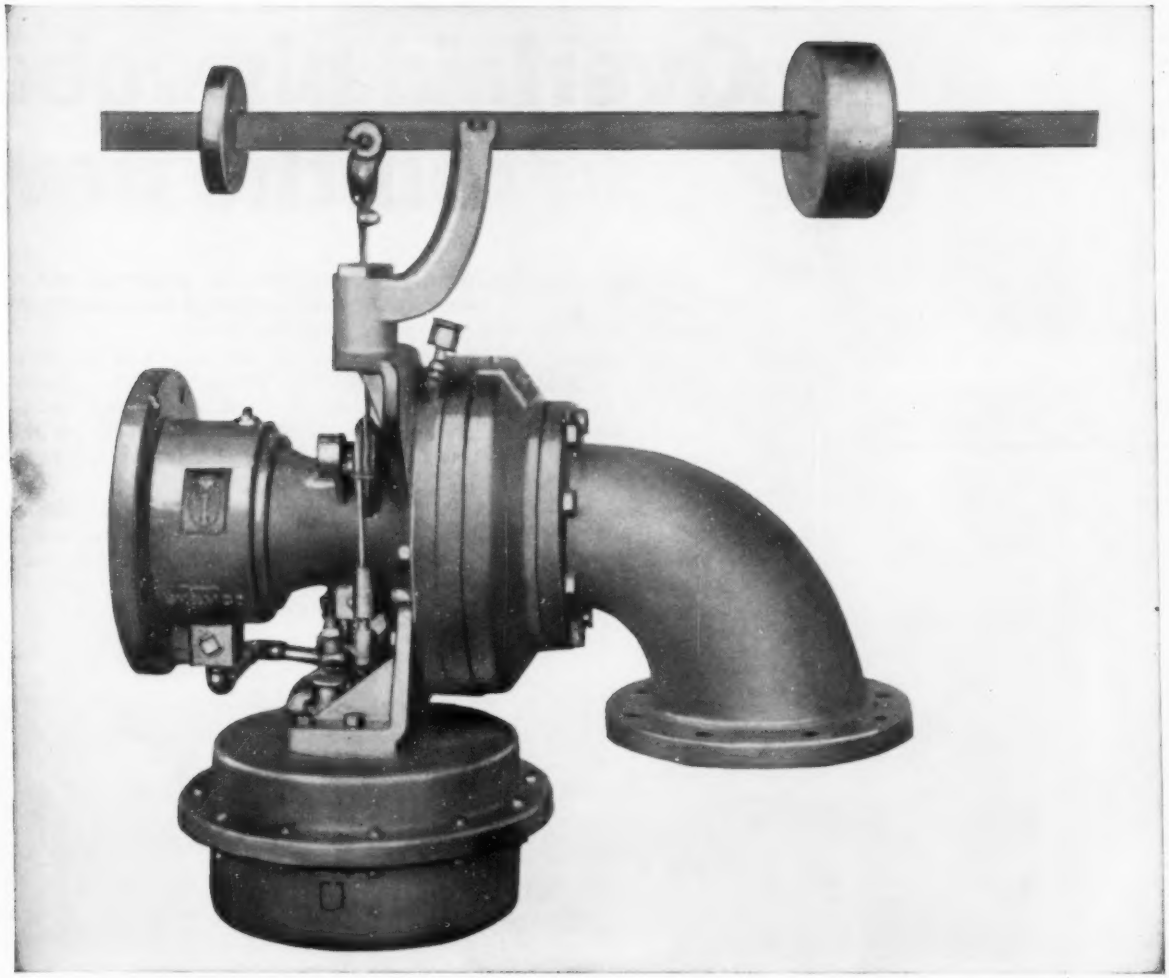
Sincerely yours,

Reed McKinley

Reed McKinley, Director of Public Works Kansas City, Mo., and General Chairman 1958 Public Works Congress & Equipment Show

AMERICAN PUBLIC WORKS ASSOCIATION

General Offices: 1313 E. 60th Street, Chicago 37, Illinois Phone FAirfax 4-3400



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keep filter rate uniform without outside power sources

Important? Yes! Because it eliminates the danger of run-away filters when power sources fail. In addition, you get continuing accurate control to the wide-open position . . . for longer runs. You save on pumping with full-area opening . . . and no flow obstructions at the wide-open position.

Compact Type "S" Controller is only three pipe diameters long. Fits anywhere—horizontally or vertically. Eliminates expense of straight-pipe approaches. Proven by twenty-five years' trouble-free service. And with virtually no maintenance—saves you money in the long run.

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Venturi Tubes • Flumes • Meters • Gauges
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Send me new technical bulletin 900 that gives valuable design and performance data on Filter Controllers and Master Control Systems.

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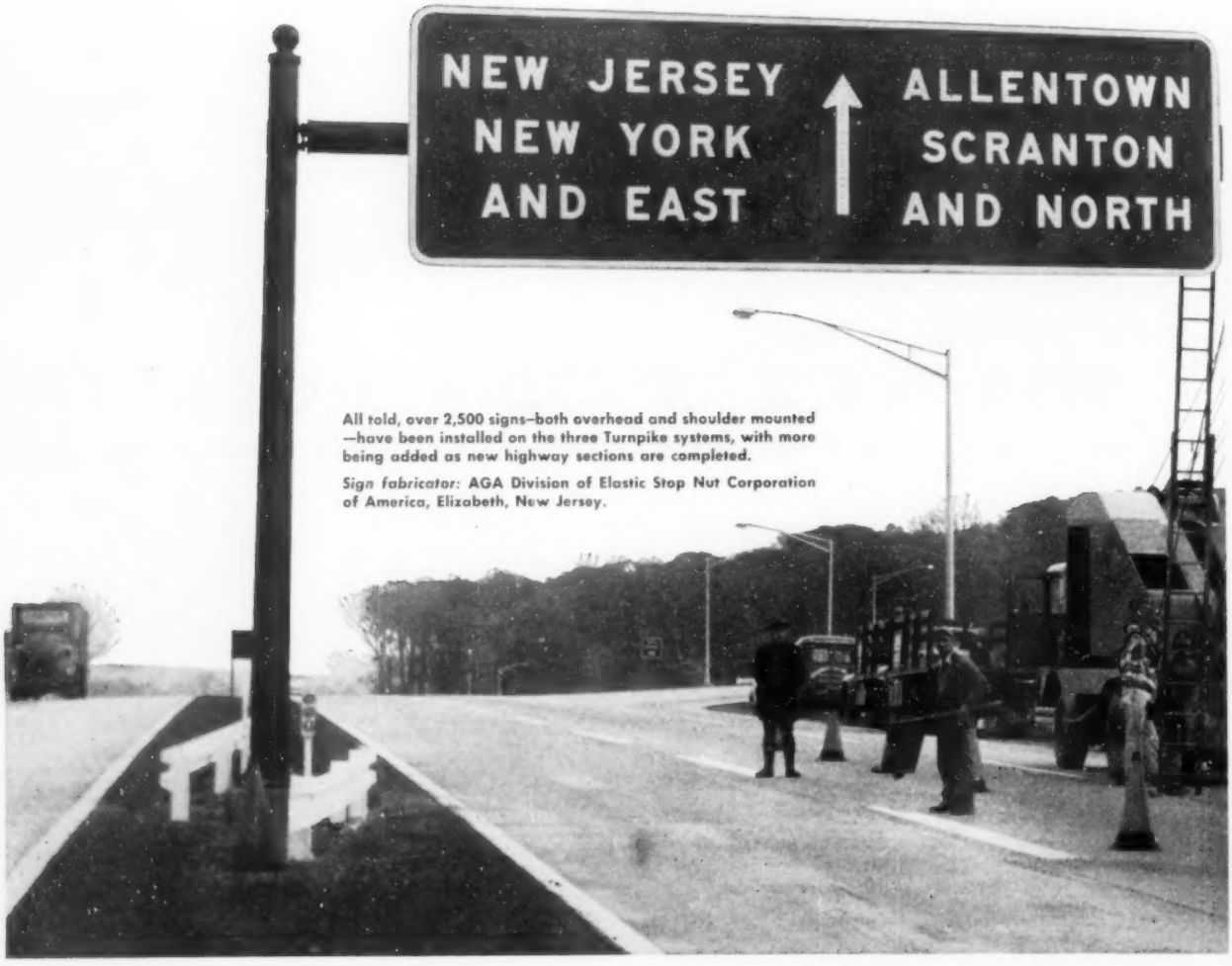
New York State Thruway
Pennsylvania Turnpike

Overlaid plywood on the new

KING SIZE OVERLAID PLYWOOD SIGNS take the guesswork out of motoring along the new controlled access highways that speed traffic to and from the busy Eastern metropolitan areas.

Strategically located and reflectorized for nighttime legibility, these bright, easy-to-read signs make the New York Thruway and Pennsylvania and New Jersey Turnpikes a prime example of efficient highway signing. And because they cost less than signs of other materials—both initially and in long-term maintenance—overlaid plywood helps do this better signing job for less money.

Signs of overlaid plywood stand up better under severe weathering, deliberate or accidental abuse. Plywood's strength and stiffness simplifies framing. Standard panels can be easily cut or combined to make signs of any size or design. The durable plastic-like overlay prevents checking, provides an ideal base for paint or reflectorizing.



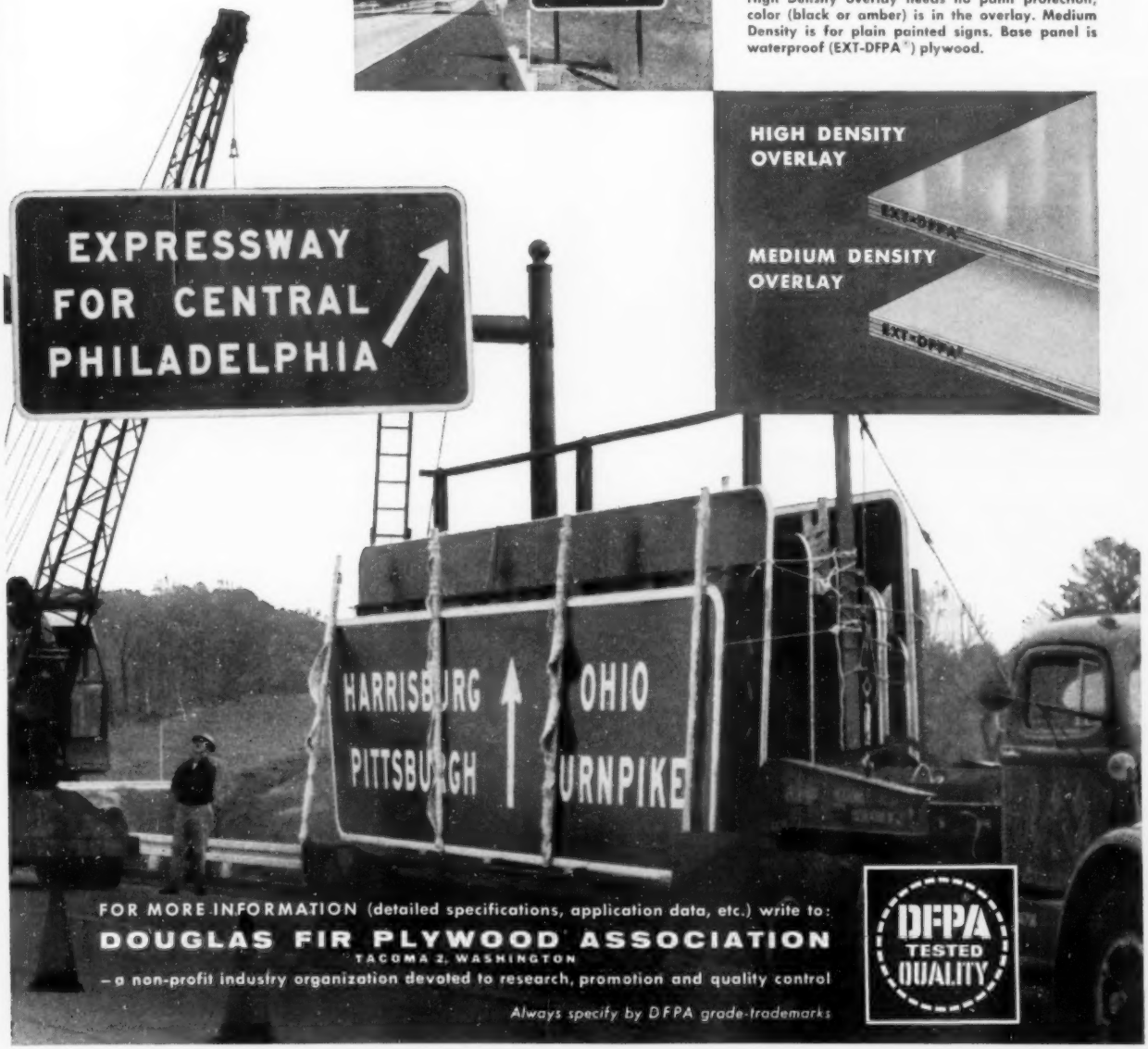
All told, over 2,500 signs—both overhead and shoulder mounted—have been installed on the three Turnpike systems, with more being added as new highway sections are completed.

Sign fabricator: AGA Division of Elastic Stop Nut Corporation of America, Elizabeth, New Jersey.

helps cut signing costs eastern turnpike systems

Overlaid plywood sign panels are stronger, more durable than metal. On shoulder mounted signs, fir plywood's greater stiffness means backing or supporting framework can be eliminated.

Durable overlay eliminates checking, grain raise. High Density overlay needs no paint protection; color (black or amber) is in the overlay. Medium Density is for plain painted signs. Base panel is waterproof (EXT-DFPA*) plywood.



FOR MORE INFORMATION (detailed specifications, application data, etc.) write to:

DOUGLAS FIR PLYWOOD ASSOCIATION

TACOMA 2, WASHINGTON

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Always specify by DFPA grade-trademarks

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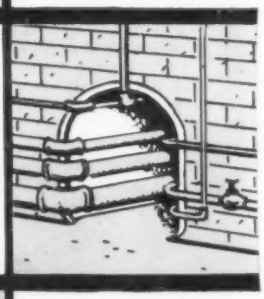
QUICK, LOW-COST ANSWER TO 4 PROBLEMS...

Flat-Base Pipe

PEDESTRIAN UNDERPASS

The practical way to safeguard the lives of adults and children. Especially valuable near schools and playgrounds. Also helps to maintain an even flow of street-level traffic.

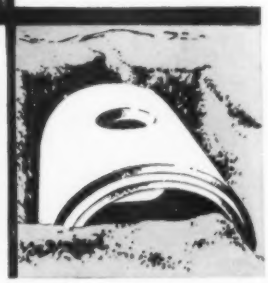


UTILITY GALLERY

Carries steam pipes, gas mains, electrical cables and telephone lines with ample room for workmen to make repairs. Flat-Base Pipe is also used for culverts and cattle passes.

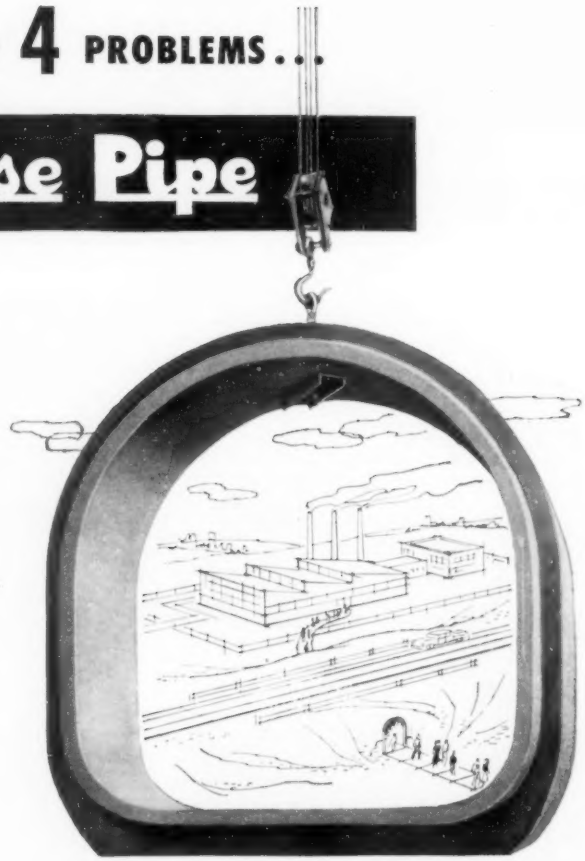
CATTLE PASS

Eliminate the hazards of road level crossings to lives and livestock with Flat-Base underpasses. Reinforced concrete Flat-Base Pipe can be jacked under railroads and highways without disturbing traffic.



UTILITY MANHOLE

Manholes for utility companies have often been built with Flat-Base Pipe in less than four hours. This eliminates needless traffic delay and reduces labor costs to a minimum.



Save as much as *30%* in the construction of pedestrian underpasses, culverts, utility galleries and manholes—with pre-cast Flat-Base Pipe. You can place and cover from 52 to 100 feet of Flat-Base Pipe in a single day. No forms to construct . . . no steel reinforcing to position . . . no concrete pouring. Can be jacked through old construction or laid in new fills. Joints are tongue and grooved and can be made watertight with rubber gaskets. Available now, in a wide variety of standard sizes.

Our technical staff will be pleased to assist you with your pipe problems

Write for free, illustrated folder on money-saving Flat-Base Pipe.

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Two $tories of $avings

How Fox Mountable Sand Spreader saved manpower both summer and winter

"A faster, better seal-coating job with less men" says Clarence Cohen, Supt. of Streets, Green Bay, Wisconsin. "We have used all types of spreaders to cover over oil, but none of them give us the economy of the new Fox. We formerly had to use 4 men on a truck. Because of the cab-controlled Fox Auger Feed we now use only one man per truck to cover the same area and do a smoother, more even job."

"Two men and a Fox replaced several trucks for us" says Isaac Pole, Highway Supt., Town of New Paltz, N. Y. "During a recent snow storm I was able to sand all town roads in 7 hours with our new Fox Sand Spreader. In the past, several trucks carrying 3 men each, were required instead of the single truck with only two men. The use of the Fox, attached to our truck, made this saving in manpower possible."

The Fox Mountable Sand Spreader

not only saves manpower, but saves time and reduces truck investment. It can be mounted or dismounted on one of your trucks in 15 minutes. Breakdowns have been practically eliminated because of the *Fox Auger Feeder* which insures an even, steady flow of material without apron chains. Powerful spinner—adjustable to cover swaths from 8 feet wide to 40 feet—spreads in front of rear wheels as well as behind. These are but a *few* of the advantages of the new Fox Mountable Sand Spreader.

To make your maintenance budget go farther—to save manpower—to sand slippery roads and streets faster and more effectively—to save time and money on seal-coating ask your Fox Dealer for a demonstration. Or if you haven't the name of the nearest dealer write, wire or phone us collect.

FOX RIVER TRACTOR CO.
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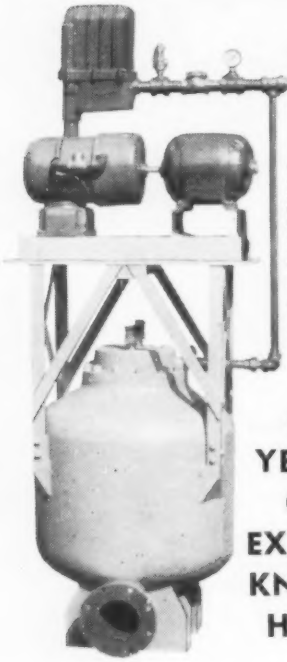
APPLETON, WISCONSIN Phone REgent 4-1451

LIFT MORE SEWAGE FOR LESS MONEY



Compact ejector system, motor compressor assembly and all contro's in one "packaged" unit. Also made in twin units.

60 YEARS OF EXPERT KNOW-HOW

CALL ON BLACKBURN-SMITH

Hundreds of pump and lift stations giving uninterrupted service with "B-S" Pneumatic Sewage Ejectors, single or twin units. Capacity 30 to 500 g.p.m. Heads up to 150 ft. No complex piping, screens, impellers, shredders, etc. Lowest installation, operating, maintenance costs.

WRITE FOR CATALOG S-55

Shows application, advantages, dimensions and layouts of B-S Pneumatic Sewage Ejectors, single and duplex units. Describes exclusive features of float, electric and pneumatic controls. Tells how to select proper size ejector.

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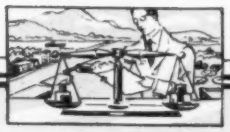

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

A Middle of the Road Case

Sutton v. City of Frankfort, 309 S.W. (2d) 344, a Kentucky case decided Jan. 24, 1958, was an action by a pedestrian against a City for personal injuries when she fell while crossing a street.

The mishap occurred in the evening, after dark, on Frankfort's Main Street. The cause of the fall was a slight step-off in the middle of the street, created by the City in the course of resurfacing when a strip of new asphalt had been laid laterally from the curbing on the south side to about the center of the street. It was two or three inches higher than the old surface. While crossing to enter a waiting automobile, the plaintiff fell when she stepped off the new pavement onto the old.

The condition had existed for several weeks, because of unexpected delay in resurfacing the other half of the street. It extended for several blocks. This section of the street was well lighted, but there were no signs or barricades to warn pedestrians of the condition.

Plaintiff had knowledge that for some time the City had been repairing this street. She was employed in a place of business in the same block where she fell. She lived on this street a few blocks east. She traveled over it every day in her husband's automobile. She had observed the work going on and she knew this strip of paving had been laid.

The court held that plaintiff was guilty of contributory negligence and could therefore recover no damages from the City.

Fireman, Save My Child

Ford v. City of Caldwell, 321 Pac. (2d) 589, an Idaho case decided Feb. 10, 1958, was an action against the City for injuries sustained by an 8-year old child when he fell through a hole in the floor of the living quarters of city firemen maintained to provide quick access to fire-fighting apparatus on the first floor of the fire station.

The child's father was employed by the City as a fireman. It was the custom and practice of the City to allow firemen's friends and family members to visit firemen in their quarters. The "ready room" contained a 27-inch hole in the floor, through which extended a vertical pole, for use by the firemen for rapid descent.

On April 20, 1955, the boy was visiting his father in the ready room. The boy had with him a rocket toy which he showed to the firemen. While the two firemen, other than the boy's father, were shooting the toy through the air, the boy fell through the hole in the floor onto the concrete floor below, sustaining serious and permanent injuries.

The court held that the City was immune from liability, because the maintenance of a fire department is a governmental activity, rather than a proprietary one. Furthermore, the fact that the City carried a liability insurance policy was held to make no difference.

Furthermore, the fact that a state statute waived governmental immunity from liability for tort to the extent of liability insurance carried, was also held to be irrelevant, because the City had procured the liability insurance prior to the date of the statute, and the statute was not construed to be retroactive.

A Boring Case

Montgomery v. City of Philadelphia, 391 Pa. 607, 139 Atl. (2d) 347, a Pennsylvania case decided March 25, 1958, was an action by a contractor against the City to recover additional costs incurred while excavating and for additional work and materials supplied in construction of a City auditorium.

The City's drawings showed the soil as decayed mica, and contained

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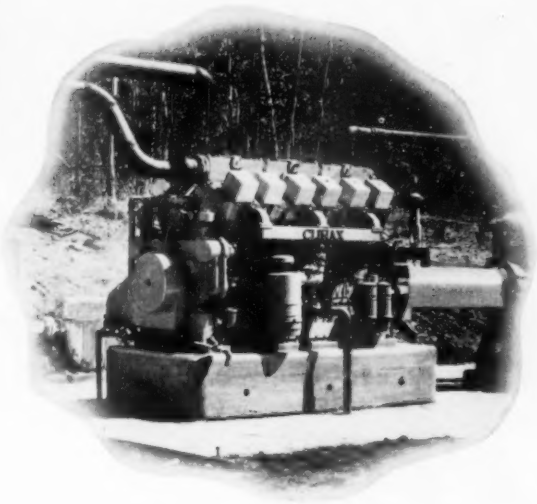

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the following provision: "The type of soil and depth at which rock may be reasonably encountered is assumed to be such as shown in the table of test borings, shown on the Drawing." Another provision of the Contract was as follows: "Where borings, test piles, and existing underground and overhead structure locations are shown, they are for the information of the City; their correctness is not guaranteed by the City, and in no event is this information to be considered as a part of the contract. If this information is used by a bidder in preparing his proposal, he must assume all risks resulting from conditions differing from the approximation shown."

The soil turned out to be not decayed mica, but rock, and the contractor therefore claimed $20,491.22 for additional work and materials.

The court held that the contractor was not permitted to rely on the provision that the test borings were "assumed" to be as shown in the Drawing, and was not entitled to anything on his claim for extra work.

A Correction

It has been brought to our attention that in the case of *Bush Building Co. v City of Barbourville, Kentucky*, 155 Fed. Supp. 394, referred to in this column in April, 1958, the decision of the Trial Court has been appealed, and this matter is now pending in the United States Court of Appeals for the Sixth Circuit. Moreover, we are informed that the statement that "the City was awarded damages equal to the difference between the $150,000 it had spent to repair the defects and the $95,653.95 it had retained against the contract price" is inaccurate; and further, that the City of Barbourville not only has not expended $150,000 to repair the defects but has spent less than $10,000, the work having been done in the course of its normal activities in the operation of the city utilities system. We regret the error and omission in the original report.

• • •

Hartford 1955 Flood Damages Cost

The total cost, to the end of 1956, for repairing 1955 flood damages to the Hartford County, Conn., Metropolitan Water District amounted to $438,963. Toward this cost, Federal aid amounted to $44,207. The remainder was financed from water revenue.

PROTECTING PEDESTRIANS

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The touch of a button gives pedestrians WALK protection at intersections with dangerously heavy vehicle traffic. At schools, churches, and shopping centers, Electro-Matic® Controllers and accessory equipment provides safe, efficient solutions to your pedestrian problems.

Electro-Matic Semi-Actuated Model 824DN and Full-Actuated Model 825DN Controllers provide a callable WALK period for the exclusive use of pedestrians, free from all traffic interference.

For details write for Bulletins C-128 and C-130

TRAFFIC ACTUATED

AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INC., NORWALK • CONNECTICUT

In Oakland, California,

Main entrance to the East Bay Pumping Station. Engineering and erection of the entire sewage system was handled by the East Bay Municipal Utility District Engineering Staff.

Four of the five Chapman Tilting Disc Check Valves installed in treatment plant of East Bay System. Each of these five valves has an average dry-weather flow of 55,000,000 gallons daily. Maximum flow for the plant is approximately 300,000,000 gallons daily.

55 million gallons per day flow quietly through five trouble-free

CHAPMAN

TILTING DISC

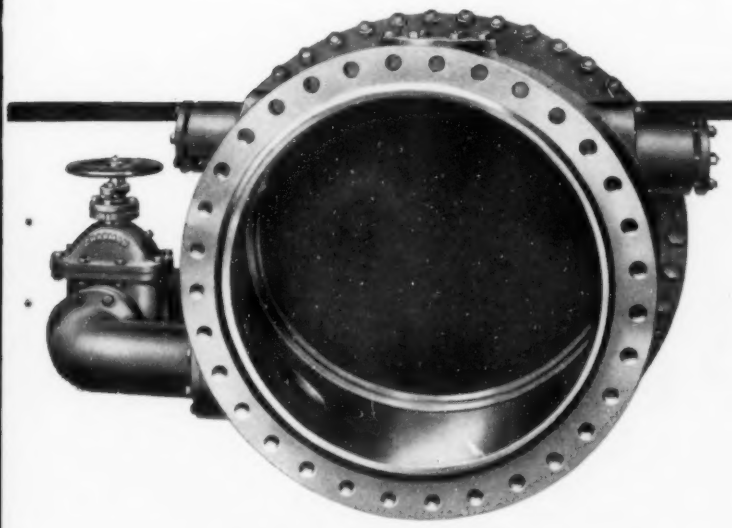
CHECK VALVES

In Oakland, California, the East Bay Sewage Disposal System serves the cities of Oakland, Berkeley, Alameda, Albany, Emeryville and Piedmont. And it serves them well. It has improved health conditions and property values in the large East Bay area.

Representing an investment of $23,500,000 this system is modern in every respect. Twenty-one miles of reinforced concrete pipe bring sewage from six cities to the central treatment plant. At the treatment plant sewage is immediately chlorinated for odor control then raised 35 feet by five 42-inch pumps to the Grit Chambers from where it can flow by gravity through the rest of the system.

Finely screened sewage is pumped up through five 42-inch Chapman Tilting Disc Check Valves to prevent any return of the sewage to the Interceptors. Today, the average flow through these five valves is 55,000,000 gallons per day, with some variations. Yet, no matter how much it varies these Chapman Valves handle the flow quietly . . . no flutter, no slamming, no banging, no damage to valve or system. The valves automatically adjust themselves to the volume of the flow.

Chapman Tilting Disc Check Valves were the first with this unique design, engineered to meet standard and unusual conditions of service. Chapman know-how is one of the many reasons why its valves and control equipment are selected for installations of all kinds. Write, and one of our engineers will tell you more of the ways and whys.



Left: — Chapman Tilting Disc Check Valve with 6″ bypass connection similar to the Chapman Check Valves installed in the East Bay Sewage Disposal System.

Why not send for our free Catalog No. 30-B showing and giving full information on all Chapman Tilting Disc Check Valves.

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New formula BANOX is the answer to this costly corrosion problem. BANOX is an inexpensive (about one pound to every 100 pounds of salt) corrosion inhibitor that protects metal surfaces—salt-slush never has a chance. BANOX is easy to use—no special mixing is necessary—it is evenly distributed by melting snow and normal traffic movement.

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A free booklet, available now, gives you all the facts on the new BANOX, and how the salt-BANOX team can give you effective, satisfactory double-protection against snowy, icy streets this winter. Write for your copy today.

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SOLVES "STICKY" BUDGET PROBLEMS, BECAUSE IT CONVERTS INTO EIGHT DIFFERENT MACHINES!

Now, you can eliminate the "squeeze" that costly specialty equipment is putting on your budget with just one versatile machine! In a matter of minutes, the powerful, new Work Bull 1001 can be converted from a ⅞-cu. yd. Loader to a Ram Pick-Up Street Sweeper, Backhoe (with its own Backfill Blade), Rotary Broom, Angle Dozer, Lift Fork, Swinging Crane . . . then, back to a Loader with Scarifier attachment! And, it performs each of its jobs so well you will think that it is made for just that one purpose!

INSTANT REVERSING, POWER, SPEED, AND MANEUVERABILITY! Besides its unsurpassed versatility, the Work Bull 1001 features instant-reversing without shifting, 60.3-hp engine, full-time power steering, torque converter, five speeds forward and five reverse, individual turning brakes, and dozens of other years-ahead features that will increase your production while actually lowering operating costs!

LOW PACKAGE PRICE FITS ALMOST ANY BUDGET! Despite its advanced engineering, top-quality construction, and exclusive performance features, the Work Bull 1001 is priced very low. In fact, your cost including all its power-matched attachments is less than what you are accustomed to paying for most single-use machines! Better still, you can buy just the equipment necessary for current operations . . . add attachments when you need them. No additional hydraulics are required when you make additions, since the 1001 comes equipped with three-spool bank-type valve (five spool for units with Pick-Up Sweeper).

OTHER MASSEY-FERGUSON POWER-MATCHED PACKAGES include the Work Bull 202 Tractor (40 hp), Work Bull 303 Tractor (54.5 hp), Work Bull Fork Lift, and Davis Loaders and Backhoes . . . plus a multitude of integrated attachments for each basic rig.

Ram Pick-Up Sweeper attachment has 63" broom, gutter, brush, sprinklers; dumps into truck.

The Work Bull 1001 as a Rotary Broom has 96" swath, 30° left and right hydraulic angle control.

Davis Backhoe on Work Bull 202 digs at right angles, or flush alongside walls, fences, etc.

For information on the complete Massey-Ferguson line, ask for Brochure G-4. For specific information on the Work Bull 1001, ask for Brochure W-1. Write Massey-Ferguson Industrial Division, 1009 South West Street, Wichita 13N, Kansas.

MASSEY-FERGUSON
INDUSTRIAL DIVISION

How perforated pipe drains water that seeps upward

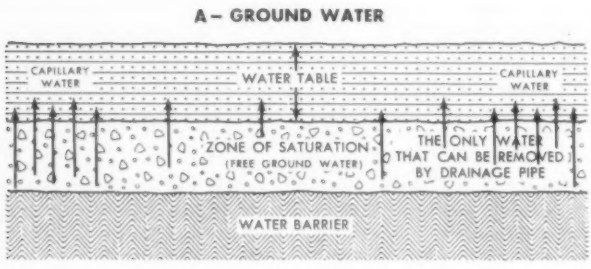
Every good engineer knows the havoc that can be caused by excessive ground water. And much of the trouble can be caused by capillary water that seeps *up* from a reservoir of "free water" underground.

Perforated pipe made from Beth-Cu-Loy galvanized corrugated sheets is very effective in removing free ground water which supplies the capillary water to the subgrade. Properly installed, such pipe collects and removes ground water which first percolates downward by gravity through porous material, then seeps through the perforations into the pipe.

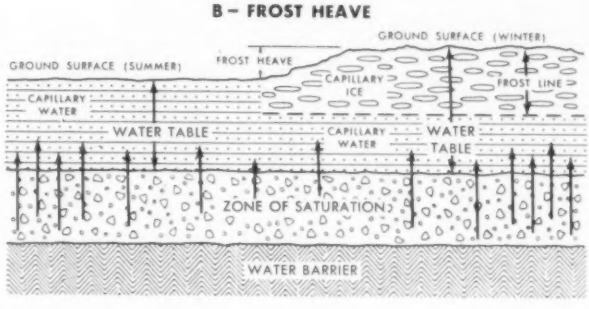
Perforated pipe is placed in a trench of predetermined depth, *usually with the perforations down*. In certain cases a series of parallel trenches is required, particularly where there are wide areas with the ground-water level directly beneath the surface of the ground.

Pipe made from Beth-Cu-Loy sheets is ideal for subdrainage applications. Such pipe is strong, long-lasting and relatively inexpensive. It is flexible, too, which enables it to enlist the aid of the surrounding material to support the imposed loads. In all respects, Beth-Cu-Loy meets the rigid specs of the AASHO.

Bethlehem does not fabricate culvert or drainage pipe. But we do manufacture galvanized Beth-Cu-Loy (copper-bearing steel) sheets which fabricators make into pipe. If you would like further information about Beth-Cu-Loy, or the pipe made from it, just write to the address below and ask for Booklet No. 425-A, "Solving Drainage Problems."

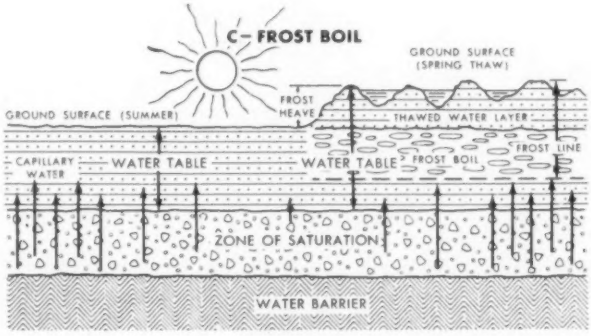

A – GROUND WATER
CAPILLARY WATER
WATER TABLE
CAPILLARY WATER
ZONE OF SATURATION (FREE GROUND WATER)
THE ONLY WATER THAT CAN BE REMOVED BY DRAINAGE PIPE
WATER BARRIER

REMOVE FREE WATER. Water that enters the soil from the surface gravitates downward until it reaches the "zone of saturation." As shown in the sketch, this is the only water that can be removed by drainage pipe. However, with this free water removed, the amount of capillary water is greatly reduced since capillary water in the soil depends on the water table, and will fluctuate accordingly.

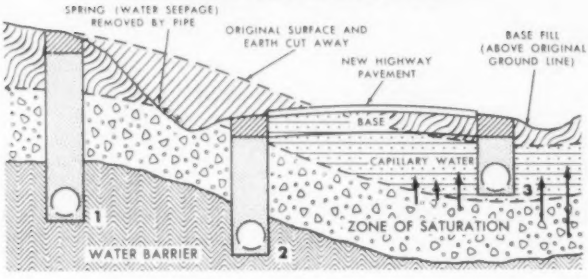


FROST HEAVE RAISES HAVOC. Research indicates that capillary water is the major cause of frost heave. Freezing seems to withdraw water from the soil, and this free water forms free ice. Soil and water become frozen as a mass. More capillary water is attracted to the soil, and is in turn expelled as free ice. This continues until the supply of capillary water is exhausted or cut off by a rapid rate of freezing.

FROST BOIL—ANOTHER VILLAIN. Frost boil acts like an ice barrier, preventing thawed surface water from percolating by gravity to the water table below. Under a pavement, surface soil water can also be sucked up by the pumping action of passing traffic. This water is very harmful because it lowers the stability of the soil in the subgrade, and when the water freezes, it can damage or destroy the surface of the highway.



D – CORRECT PLACEMENT OF PIPE



E – GROUND WATER REDUCED

CORRECT PLACEMENT OF PIPE. Pipe 1 will intercept the ground water that became a problem when a bank was cut away during construction of a new highway. Pipe 2 is placed correctly to intercept free ground water on the side of the natural slope. Pipe 3, however, would be ineffectual for two reasons: it is placed on the wrong side of the new highway to intercept the ground water before it reaches the foundation; and the trench is not deep enough to permit the pipe to intercept the ground water under any circumstances.

GROUND WATER REDUCED. Here is an effective use of perforated pipe for lowering the water table. When properly designed and laid in trenches parallel to the roadway, the perforated pipe will draw off ground water, as shown.

For further information about Beth-Cu-Loy, and the pipe made from it, write to the address below for copy of Booklet 425-A, "Solving Drainage Problems."

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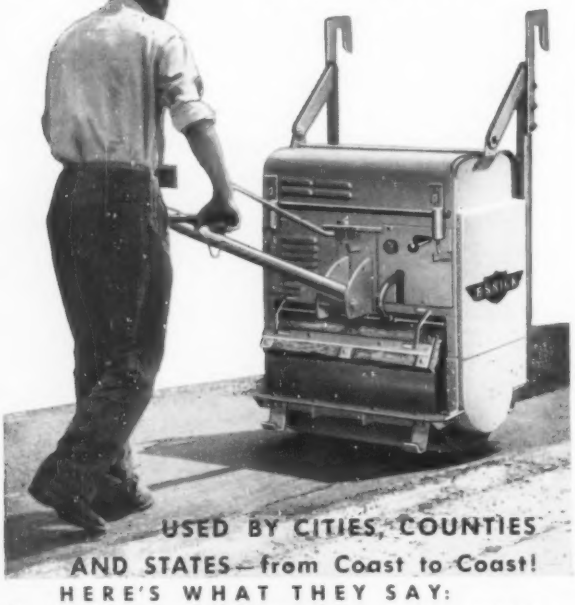

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HERE'S WHAT THEY SAY:

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- "**BEING SELF PROPELLED** it is easily operated....rapid expert work can be produced with little or no effort."
- "**THE CARRYING HANGERS** (patent pending) for tail gate attachment provides the most convenient and lowest cost haulage we have ever experienced in our paving maintenance."

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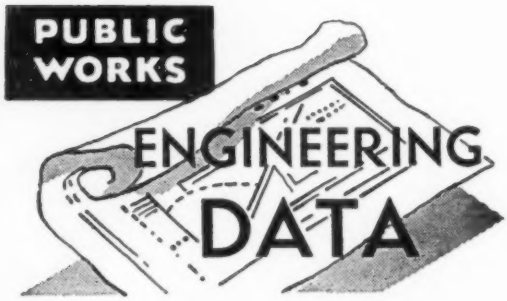


Cost Data on Public Works Activities

Records of man-hour production and costs of performing various public works activities are maintained by San Diego, Calif. The following covers work activities from July 1, 1957, through Feb. 28, 1958. Costs given include all labor, materials, equipment and related costs.

Garbage collected amounted to 10,346 tons requiring 5.07 manhours per ton at a cost of $15.46; refuse collected 104,376 tons at 2.11 manhours and $6.16 per ton.

Traffic line painting, 4 ins. wide, aggregating 334 miles required 5.88 manhours and $32.25 per mile. Pavement surface repairs per 100 sq. ft. units, 0.75 manhour and $6.26; total units amounted to 2,769. Curb miles of streets swept by power equipment aggregated 42,434 miles, requiring 0.28 manhour and $2.06 per mile. Wood fence repainting, 7,247 lineal feet, required 0.06 manhour and 25 cents per foot.

Pumping raw sewage required 0.68 manhour and cost $2.73 per million gallons; it required 45.61 manhours and cost $177.76 for each of 435 street connections; machine cleaning of sewers required 0.51 manhour and cost $1.80 per 100 lineal feet; the total cleaned totalled 2,401,200 feet.

Parking meter overhauls required 0.69 manhour and cost $1.72 each; painting 3,936 standards required 0.08 manhour and cost 20 cents each. Collection expense amounted to 2 cents for each meter.

Moving Dirt in Michigan

Michigan road builders will move more than 35 million cubic yards of earth during 1958 in carrying out the State Highway Department's construction needs program for the year. The 52 million tons of earth and rock involved (comparable in volume to a plateau about one mile square and 35 feet high) will be dug, scraped and graded with the use of mechanized equipment which makes earth-moving machines of even a decade ago seem small in comparison.

The 1958 excavating job will cost more than $11 million, based on the 1957 average of 32 cents for each yard moved. Oddly, excavation cost has been one of the few items in highway construction which has actually decreased from peaks set in the war years. In 1940 it cost 19 cents for each cubic yard of earth moved on Michigan highway construction. Then followed a steady rise, reaching a peak of 40 cents per cubic yard in 1943. A gradual decline in costs followed, and by 1949 it cost only 24 cents a yard. Since 1949, costs have fluctuated between 28 and 32 cents.

A workhorse of the excavation industry today is the 30-ton scraper, capable of taking up 15 cubic

Use VITRIFIED CLAY Underdrains

Only then are you sure of lifetime, reliable service. They provide for trickling filters what no substitute can possibly give—complete permanent protection against acids, alkalis and bacterial actions.

ASTM Specifications insure good trickling filter underdrains . . . insure that you get what you need.

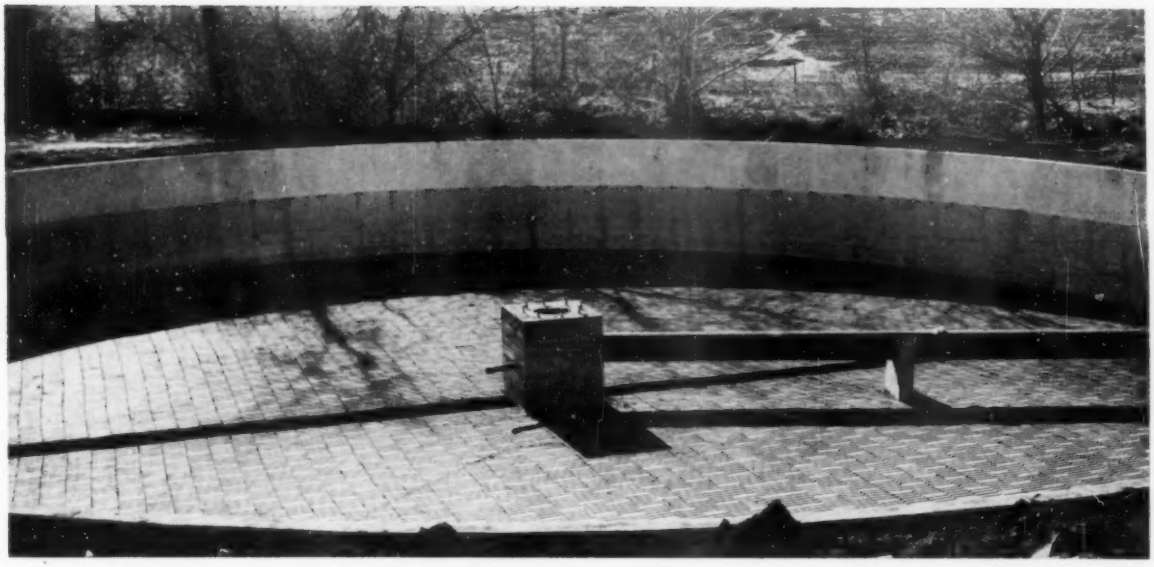
TFFI members supply VITRIFIED CLAY underdrains that **exceed** ASTM requirements.

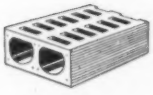
TFFI VITRIFIED CLAY underdrains are made in modern plants, under modern controls usually impossible with substitutes. TFFI Specification blocks are certified by responsible maker-members of the TFFI. Ask about the 50-year guarantee of life.

Get built-in protection in your trickling filters

Trickling Filters' Great Advantages

For your new sewage treatment plant use TRICKLING FILTERS with VITRIFIED CLAY underdrains. Among the six great advantages of trickling filters are their low initial cost, low operating cost and—where TFFI VITRIFIED CLAY underdrains are used—their long-term maintenance economies as well.





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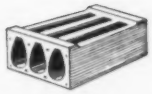

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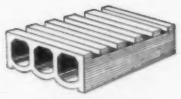
327 Fifth Ave.
Pittsburgh 22, Pa.



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Texas Vitrified Pipe Co.
Mineral Wells, Texas

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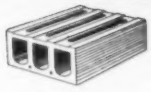
Symbol of good treatment



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WAUSAU-
FIGHTING EQUIPMENT

SNOW REMOVAL
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WAUSAU specialists in snow plows . . . 55 models and 9 types to select from . . . equipped with the finest of a full range of hydraulic controls to meet your individual requirements . . . will take more punishment, cost less to operate, and do the job better.

MATERIAL SPREADERS

Quick action spreading is a feature of this low cost self-contained unit that may be attached or disconnected in a minute. It has positive control of thickness, width, and direction of spread . . . operates only when body is raised—stops when body is lowered . . . no hazard to passing vehicles . . . sturdily built throughout for long service . . . width of spread 8 to 20 feet—hopper capacity 2 cubic feet.

TRUCK GRADER ICE BLADE

Maintains, cuts and grades all types of gravel and dirt roads, eliminates ruts, holes, and washboards. For winter operation it planes, breaks, and removes ice and hard-packed snow hazards . . . truly a versatile year 'round maintenance unit . . . full power hydraulic cab control.

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WAUSAU IRON WORKS
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Pioneer Snow Plow Builders
Truck Patrol Ice Planer and Material Spreaders

yards of earth, about twice as much as a similar piece of equipment could accomplish 10 years ago. Bulldozers, draglines and smaller scrapers and graders are also used for the lighter work along shoulders and slopes. A large part of the 1958 earth moving work will be over new expressway routes, where it is estimated that more than a quarter of a million cubic yards of earth must be moved for each mile of future dual highway.

Excavation for expressway routes through metropolitan areas is considered the most difficult because of the extra problem of disposal. In rural areas, this problem is handled by transferring excess earth from one section of roadway to fill in depressed areas in other sections.

Winter Maintenance Operations on the New York Thruway

Estimated cost of snow and ice removal for the winter of 1957-1958 for the New York Thruway was $1,350,000, or an average of about $2,700 per mile. Equipment used in this operation is valued at approximately $3,200,000. Detailed weather forecasts are received from the U. S. Weather Bureau and from a private weather-forecasting service. These are relayed to the four Division headquarters by teletype, and broadcast to all maintenance units in the affected area. Virtually all maintenance vehicles are equipped with two-way radios, and their operating locations are plotted on a large control board at the Communications Center. Utilization of this board and direct radio communications permits engineers to direct the fight against snow and ice storms from this headquarters. This information was taken from the 8th Annual Report, New York State Thruway Authority.

A Basis for Storm Sewer Construction Costs

A study of storm sewer construction costs over the past three years was reported by W. P. Schmitz, Engineer in Charge, Construction Division, Dept. of Public Works, Milwaukee, Wisc., at a recent meeting of the Wisconsin Chapter APWA. Costs of the period were averaged for the size classifications and various types of construction. The average lineal foot prices were divided by the pipe area to find the average cost per square foot of cross-sectional area, which is what is actually bought. The only contract prices considered in the study were for sewers installed at normal depths and for those with earth backfill when open cut methods were used.

The classifications used in Milwaukee are as follows: (1) Pre-cast pipe covers the installation of all bell and spigot and tongue and groove pipe from 12 to 108-inch in diameter. These pipes are bedded in sand; pea gravel with sand is vibrated to the ¾-point of the pipe and 2 feet of fine material is then backfilled by hand over the top of the pipe. (2) Monolithic concrete tunnel covers all concrete tunnel construction from 48 to 90-inch in diameter. The barrel thickness of these structures vary from 9 to 12 inches, using 5½-bag mix concrete pumped into place. (3) Pre-cast concrete pipe tunnel includes all pre-cast concrete pipe installed by tunnel construction with the space between the pipe structure and the tunnel timbers filled with a 1 to 12 mix of Portland Cement and gravel. (4) Lo-Head pre-cast concrete pipe of an elliptical shape bedded in either limestone screenings or pea gravel. (5) Corrugated metal pipe arches includes pipe arches assembled in the field from sections of corrugated metal bedded

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"OPERATES 1693 HOURS without a breakdown of any kind!"

WELDON S. CAMPBELL
64 MUNSON STREET
GREENFIELD, MASSACHUSETTS

February 4, 1958

Fitchburg Engineering Corporation
Fitchburg, Mass.
Mr. Perini, Superintendent

Dear Sir:

On March 23, 1955, we purchased one of your Chippers. You may be interested to know that this machine operated a total of 1,693 hours without a breakdown of any kind. Inasmuch as we are paid for running time only we often start up the chipper 20 or more times daily.

We have followed faithfully your instructions in using a hone on the knives each morning, we find that by doing this we can use the knives for five weeks before sharpening. Even then only about 12 thousands are needed to bring them back.

Contractors find your chipper is ideal and saves them much time and dollars in clearing a woodland area before bull dozing begins.

Your Engineering skill and knowhow has resulted in the finest of all Chippers and I have seen them all in operation.

Hauling time is reduced two-thirds, this results in a large saving in gasoline, parts and labor. I would never again be without one.

Respectfully,

Weldon S. Campbell

Weldon S. Campbell
Tree Warden & Moth Supt.
Greenfield, Mass.

"Our Fitchburg Chipper has been inexpensive to maintain and trouble-free in operation, and has meant a great saving to us in time and labor."
—F. A. Canuso & Sons, Inc.
Philadelphia, Pennsylvania

"During about 2,000 operating hours we have suffered neither employee accident due to chipper operation, nor major mechanical failure."
—Northern Tree Company, Inc.
Petoskey, Michigan

"The Fitchburg Chipper is well constructed. The machine is trouble-free and easily maintained."
—John Glasgow, Supt. of P. W.
Township of Mahwah, New Jersey

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs.

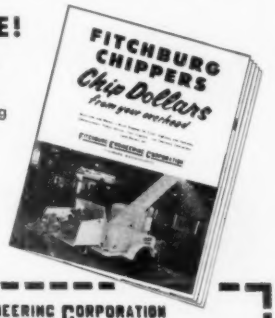
That's the "reason why" successful men like Weldon Campbell prefer Fitchburg for the tough brush removal jobs.

Fitchburg Chippers are designed by engineers for busy, trouble-free service. The exclusive spring-activated feed plate adjusts itself automatically—provides protection from damaging foreign material—assures smooth, efficient operation. The power take-off clutch gives safe starts and stops. There's no fly wheel to cause bearing trouble. These features keep a Fitchburg Chipper on the job . . . save you time and money.

Read (at right) what others say about their Fitchburg Wood Chippers, and send for your free copy of "Chip Dollars" today.

NEW! FREE!
Book of Facts

Detailed cutaway drawings of Fitchburg Chipper in color. Specifications, diagrams, charts, plus money-saving reports and experiences of others.



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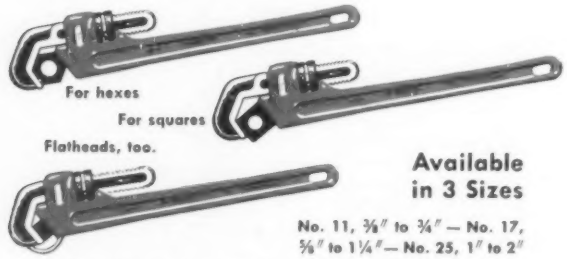
Hex Wrench

gives you Time-Saving, Positive, 4-Sided Grip on Hex Nuts, Square Nuts, Valve Packing Nuts, Unions, Gas Cocks

Here's the adjustable wrench you've always needed for hexes, squares and flatheads, rough or finished. Extra useful on every job. No more barked knuckles or rounded nut shoulders. New wide-open jaw goes on easy . . . won't slip off. 4-sided grip gives extra leverage. Stays to adjusted size during use.



Available in 3 Sizes

No. 11, 3/8" to 3/4" — No. 17, 5/8" to 1 1/4" — No. 25, 1" to 2"

Famous RIDGID heavy-duty construction with guaranteed housing. Narrow jaw design makes work easy in tight places even on thin nuts. Comfort-grip I-beam handle has handy hang-up hole. The new RIDGID Hex Wrench gives you more for your money than wrenches costing twice as much. Try it, buy it at your Wholesaler's.

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in limestone screenings or crushed road gravel. Backfill material is placed up to the arch of the pipe and mechanically tamped in place with shallow lifts. (6) Large diameter corrugated metal pipe includes all larger diameter metal pipe of circular section usually installed in a trench of a shaped bottom or bedded as described for pipe arches. (7) Reinforced concrete box sewers includes all single or double box sections of reinforced concrete cast in place with metal or wood forms and with 5½-bag mix concrete. (8) Large diameter monolithic reinforced sewers include all circular sections cast in place with 5½-bag mix concrete.

The data presented by Mr. Schmitz are given below in a rearranged form to show the cost per square foot of cross-sectional area for the various sizes of openings. For areas of 75 sq. ft. and greater, large diameter monolithic reinforced sewers (8 above) cost $1.29 to $1.44; reinforced concrete box sewers (7 above) $1.14 to $1.45; and corrugated metal pipe arches (5 above) $1.54.

Cost per square foot of opening for areas of 50 to 75 sq. ft., were reported for (1) above at $1.48 to $1.68; for (5) $1.41; for (7) $1.43 to $1.54; and for (8) $1.75. For openings of 30 to 50 sq. ft., costs were, for (1) $1.73 to $2.11; for (2) $2.17 to $2.83 for (6) $1.32; for (7) $1.61 to $2.00; and for (8) $1.91. For openings 15 to 30 sq. ft., costs were for (1) $1.97 to $2.08; for (2) $3.05 to $3.59; for (4) $2.34 to $2.37; for (5) $3.10; for (6) $1.50 to $1.63.

For openings of 7 to 15 sq. ft., costs were for (1) $2.29 to $2.75; for (2) $5.18; and for (3) $12.10. For openings under 7 sq. ft., costs for (1) ranged from $3.00 to $5.50 and for (3) from $14.70 to $40.50.

County Road Commission Handles Sanitary Engineering

The Board of Supervisors of Van Buren Co., Mich., has designated the County Road Commission as the county agency having authority for establishing and/or providing sewers and sewage disposal facilities; water mains, pumping stations and purification plants; and garbage and rubbish disposal facilities.

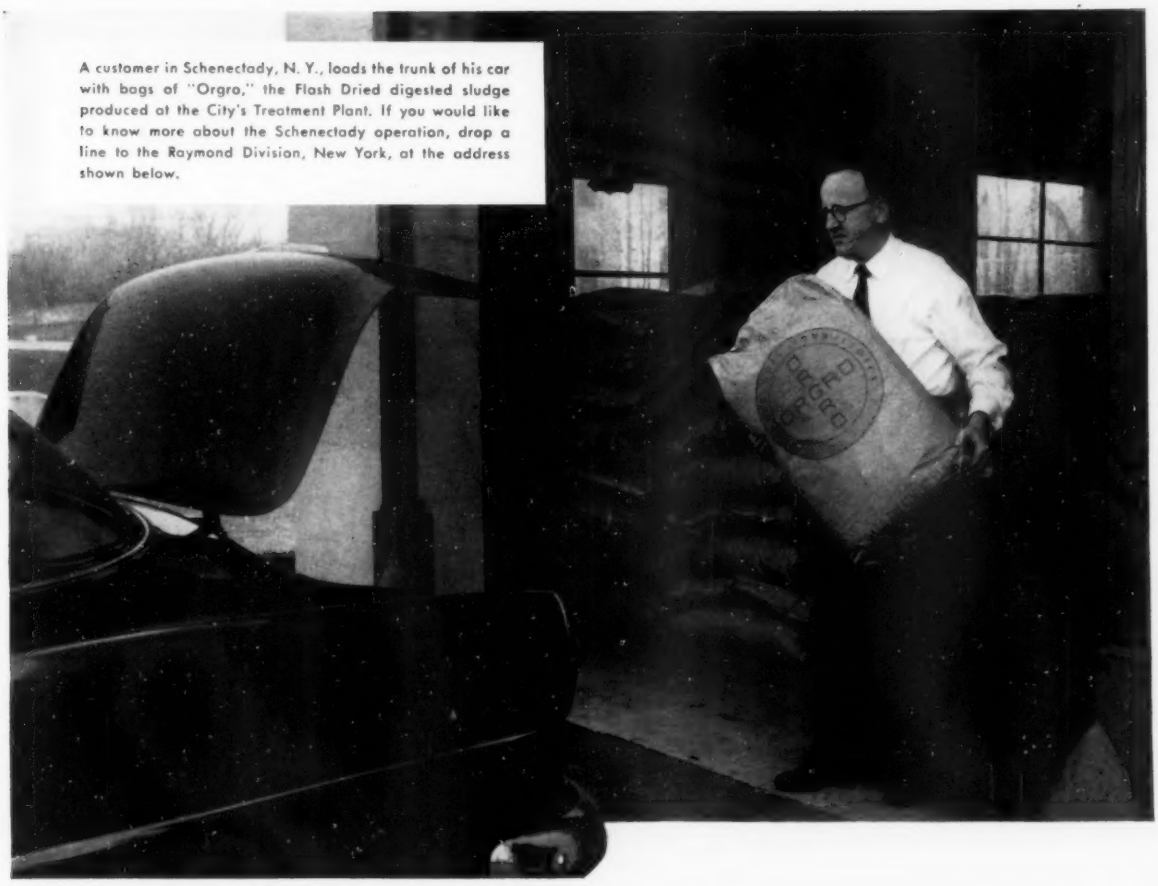
The board has begun studies of the extension of the City of South Haven's sanitary sewer facilities to service an area in South Haven Township. Plans, estimates and assessment rolls have been prepared. This project will cost an estimated $49,629.95. The Board is also considering sewer projects in other portions of the county and several townships have expressed a desire for garbage and rubbish disposal services.

Greater Winnipeg Water District

The following data appeared in the Annual Report of the Greater Winnipeg Water District, Winnipeg, Manitoba. This report is for the year ended December 31, 1957. N. S. Bubbis is General Manager and H. Shand is Assistant General Manager.

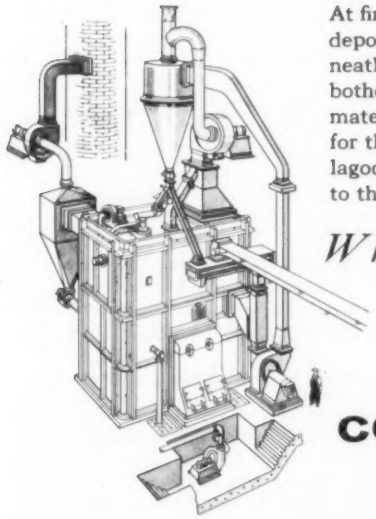
The population served with water increased from 401,800 in 1956 to 413,800 in 1957. The amount of water supplied to all municipalities in 1957 declined by about 2 percent. The consumption of water was 11,338,327,000 gallons, or an average of 31.06 million gallons per day. Sales of water amounted to $577,309.26, with a surplus of $318,295.60 being realized in the department at the end of the year. The water comes from Lake of the Woods, which is 96.5 miles from Winnipeg.

Fluoridation has been in effect since December, 1956. Difficulty was experienced with the sodium



A customer in Schenectady, N. Y., loads the trunk of his car with bags of "Orgro," the Flash Dried digested sludge produced at the City's Treatment Plant. If you would like to know more about the Schenectady operation, drop a line to the Raymond Division, New York, at the address shown below.

Can you think of a better way to dispose of sewage sludge?



At first glance, the trunk of a car may seem to be a peculiar place to deposit sewage sludge. But when the sludge is dry, sterile and neatly packaged, it can be a marketable commodity rather than a bothersome waste. When uncontaminated with noxious industrial materials, it is an excellent soil conditioner. Its sale produces revenue for the treatment plant, eliminates the nuisances of drying beds, lagoons and ash disposal and, at the same time, renders a service to the people of the community.

What's the best method of drying sludge?

It's the C-E Raymond Flash Drying System, a system used by communities large and small across the nation, a system proved in service and one which dries more filter cake than all other systems combined.

COMBUSTION ENGINEERING

C-E

C-159

RAYMOND DIVISION, 1315 North Branch Street, Chicago 22, Illinois
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ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

Trenching and excavating need not hold up schedules when you have a HOPTO. Model 200 HOPTO has a fast, smooth cycle, a 200° uninterrupted swing, and a digging capacity and ease of operation that knows no equal in its size and class range! Trenching or 'square-cornered digging' is simply handled by 180° wrist action of bucket.

HOPTO digs 13½ feet deep . . . is easily converted to shovel bucket in ten minutes! It's the field-proven hydraulic excavator that equips you to do more work, *in less time, at lower equipment investment.*

There's a HOPTO model to exactly fit YOUR requirements . . . exceed your expectations

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Sadger Division Dept. PW Winona, Minnesota

Please send me complete specifications on the models most frequently used in my field.

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Address_____

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silicofluoride, because the fine material was sticking or arching in the overhead storage hopper. Modifications have been made on the hoppers, consisting of a centrally mounted shaft that has stirring vanes attached. The whole assembly is rotated by an electric motor through reduction gears. This equipment is now being tested and if successful, will enable the District to use almost any grade of sodium silicofluoride meeting the chemical specification.

The District owns and operates a railroad that returned a profit of $108,925 during 1957. The motive power consists of three 44-ton diesel electric locomotives, one diesel electric rail car and one gasoline driven rail car.

Highway Maintenance For Wayne County, Michigan

During the winter and spring of 1957, a total of 7,304 tons of cold-patching materials were used on county roads and state highways in Wayne County, Michigan.

There were 14,487 lineal feet of flexible, metal guard rail installed on county roads and state highways. The railing comes in sections 12½ ft. long and 13 ins. high and is installed approximately one foot above the ground to the bottom of the rail on 6 in. square, white-oak posts. The sections are bolted together and run continuously for the entire danger area.

In snow and ice control 70,107 tons of salt were used and the Division operated 110 snow plows and 14 motor patrols. Snow fences were erected on private property, 50 to 100 ft. off the right-of-way.

The Division painted 4 in. wide reflectorized lines on 1,956 lineal miles of pavement, 383 crosswalk lines, 241 stop lines and 412 school signs. The following materials were used: 11,499 gals. of white marking paint: 9,731 gals. of yellow paint and 2,307 gals. of black paint.

This information was abstracted from the Fifty-first Annual Report for the fiscal year of 1957 prepared by the Board of County Road Commissioners, County of Wayne, Detroit, Mich.

Highway Costs and Their Relationship to Vehicle Size

A research team of the Engineering Experiment Station at The Ohio State University says that three groups of highway users are responsible for more than 90 percent of the total highway costs. The statement is made in the Engineering Experiment Station Bulletin No. 168 and is a result of a two-year investigation sponsored by the Ohio Trucking Association. According to the researchers, Robert F. Baker, Robert Chieruzzi and Richard W. Bletzacker, passenger cars are responsible for 50-70 percent of highway cost, multi-unit trucks for 10-13 percent and single-unit trucks for 8-20 percent. Copies of this bulletin are available from The Executive Director, Engineering Experiment Station, The Ohio State University, Columbus, Ohio, at $3 a copy.

Equipment Purchases By a County

In a program to replace worn out equipment, Van Buren Co., Mich., in 1957, purchased the following: Five 34,000-16 GVW dump trucks; five underbody scrapers; four V-type snow plows; two station wagons; an electric generator; an electric chain saw; two mobile radios; two water tanks; a pump; and a wobble-wheel roller.

HERSEY WATER METERS

are preferred by experienced Water Works Officials and Engineers.

Get detailed information on the most complete line of Water Meters in the world from our nearest Branch Office or Home Office.

HERSEY MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO SAN FRANCISCO — LOS ANGELES

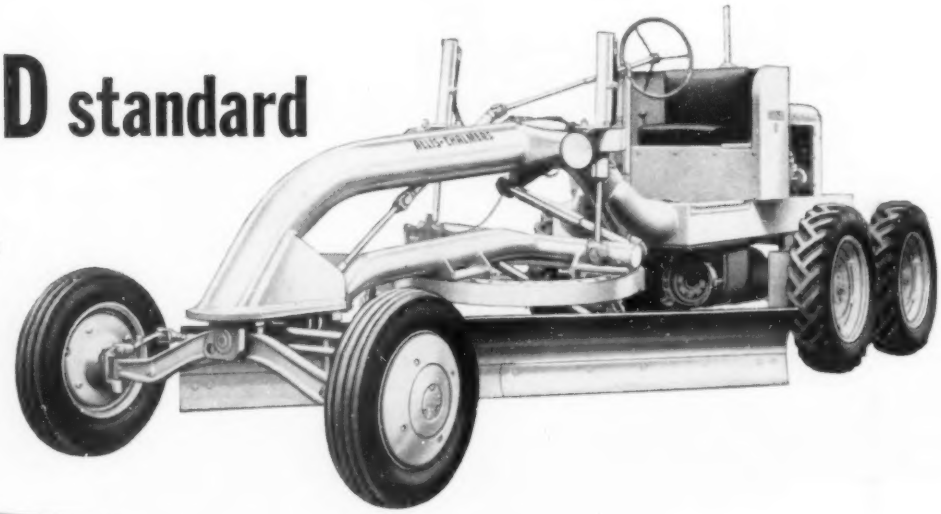
...for big economy on maintenance

GET THE ALLIS-CHALMERS

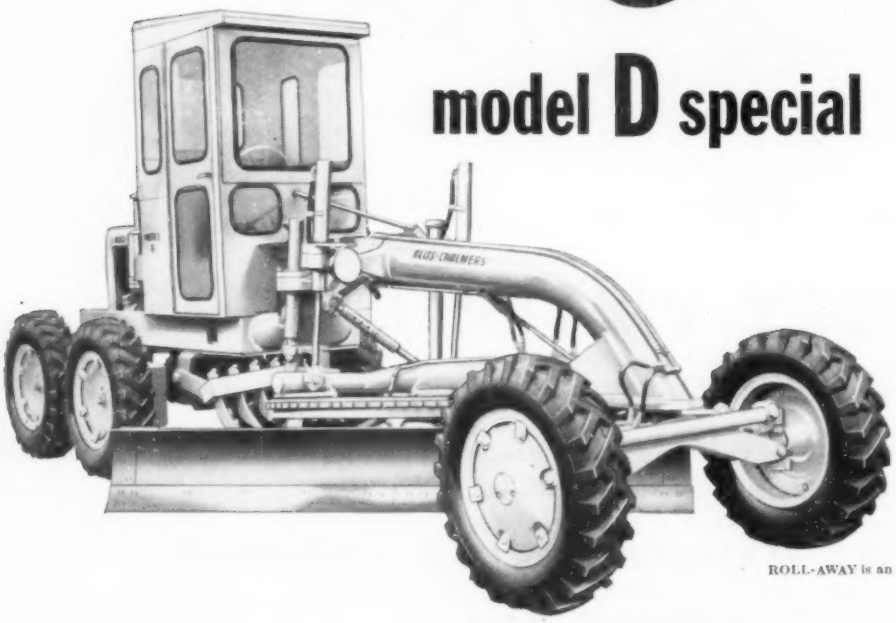
Here's the original low-cost motor grader with big-grader design and performance advantages. The Model D handles so many jobs so well, you have to see it at work to convince yourself. Your Allis-Chalmers dealer can arrange a demonstration. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

model D standard

50 hp
Approx. weight
8,800 lb (gasoline)
Approx. weight
9,350 lb (diesel)



model D special



50 hp
Approx. weight
10,900 lb (gasoline)
Approx. weight
11,450 lb (diesel)
4 forward speeds to 25 mph (approx.)
1 reverse speed to 3 mph (approx.)
All-steel cab*
Shiftable moldboard*
Hydraulic scarifier*
Leaning front wheels*
Power circle turn*

*Also available with the model D standard as optional equipment.

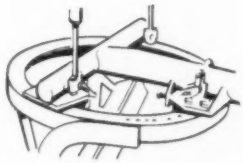
ROLL-AWAY is an Allis-Chalmers trademark.

and construction work

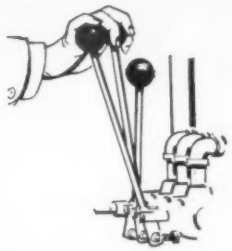
MODEL D MOTOR GRADER

many production-boosting advantages

The ROLL-AWAY moldboard rolls dirt up and ahead to eliminate packing, reducing friction . . . gives you more performance per horsepower, more production per gallon of fuel.



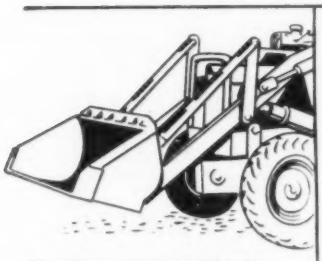
Revolving circle and heavy tubular drawbar provide exceptionally stable moldboard mounting.



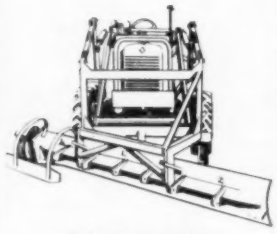
Convenient hydraulic controls, easy to operate. Two levers fit into one hand to control circle lift.

Positive tandem drive gives you four driving wheels under the heavy end of the grader.

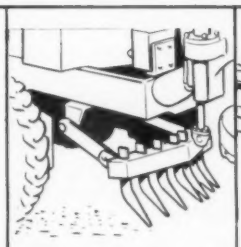
many job-multiplying attachments



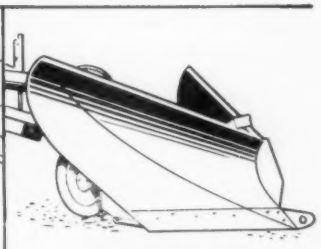
⅝-yd rear-mounted loader



Interchangeable shoulder maintainer



Midship-mounted scarifier



Blade and V-type snowplows

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

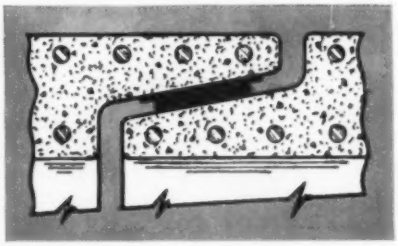
Look ahead... *move ahead*...and stay ahead

with ALLIS-CHALMERS

PREVENT JOINT LEAKS, WHIP CORROSION AND SPEED PIPE WORK ON SEWER PROJECT AT OIL CITY, PA.*

Oil Creek, a watercourse in Oil City, Pa., will be cleaner, purer, and an even greater enhancement to the beauty of the city, as a result of current work being done under Oil City's continuing sewer expansion program. Consisting of several miles of new laterals, new concrete pipe interceptors up to 36" in diameter, and a new sewage treatment plant, the facilities now being added make it possible to treat all sewage waste disposal before effluent is discharged into the river.

Engineers and officials specified Hamilton Kent TYLOX Rubber Gaskets for coupling the pipe lines, knowing they could count on TYLOX for three important advantages: leak-proof joints to keep infiltration loads negligible at the new plant; acid-resistance to prevent deterioration of the joints and necessity of future repairs; and easier, faster pipe coupling, to help keep construction costs down.



TYLOX Gaskets form a permanently tight **compression** seal. Water can't leak in or out . . . roots and sediment can't penetrate . . . acids can't destroy. Pipe can be coupled in wet trenches . . . backfill may be applied immediately.

5099

WRITE FOR ENGINEERING DETAILS ON TYLOX—
Specify TYLOX FOR YOUR PIPE PROJECTS

* **PROJECT:** Sanitary sewer expansion, Oil City, Pa.

ENGINEERS: Morris Knowles, Inc., Consultants, Pittsburgh, Pa., R. B. Fleming, Resident Engineer.

CONTRACTOR: Ben Construction Co., Pittsburgh, Pa.

PIPE: Reinforced concrete, manufactured by Concrete Pipe Co. of Ohio, Cleveland, Ohio.

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
427 West Grant Street Orchard 3-9555

CANADIAN PLANT: 10 Brussels St., New Toronto, Ont. Phone CLifford 1-2494

Vol. 89, No. 8
AUGUST, 1958

PUBLIC WORKS Magazine

Metropolitan Planning for Sewers on a County Basis

C. C. SPENCER, Director, Erie County Sewer Authority, Buffalo, New York

MOST METROPOLITAN areas have problems in providing community facilities in growing zones outside the central city. The widely scattered pattern which residential growth is taking intensifies the difficulties of providing utilities. In Erie County, this "suburbanitis" is illustrated by the accompanying map showing some current subdivisions and proposed administrative areas for sewer development. Land in areas with utilities is no longer available for expansion.

A Water Authority was established in 1948 to provide an integrated service which could be expected to meet the demands of growth. In many cases the availability of water is creating a demand for sewers. The septic tanks and tile fields which can be used for scattered rural homes must be regarded as a temporary expedient in urban areas. Health Departments in New York State are recommending against use of septic tanks for large subdivisions because of unsatisfactory experiences in some cases and because individual corrections are very difficult where numerous tanks fail. At the same time it is not possible to provide trunk sewers in all sections where growth is taking place, and it will be necessary to give first consideration to areas where the sewers are economically justified and where growth appears most probable. Where soil is not absorptive and residential development with septic tanks should be prohibited, the initiation of a stage construction program for sewers may permit present development because a long range answer is on the way.

Since the primary obstacle to sewer construction is financial, it is necessary to take advantage of any methods by which costs may be reduced and financing may be facilitated through adoption of specific governmental policies on land development and sewer construction. This includes establishment of large scale intermunicipal systems to secure lower unit costs and use of low cost methods of treatment and relatively shallow sewers wherever possible. A large number of small unrelated systems are undesirable in the long run. In addition streams of adequate size to receive effluent do not exist in many portions of the County where sub-divisions are planned, and the only way of rendering development feasible is through construction of trunk districts.

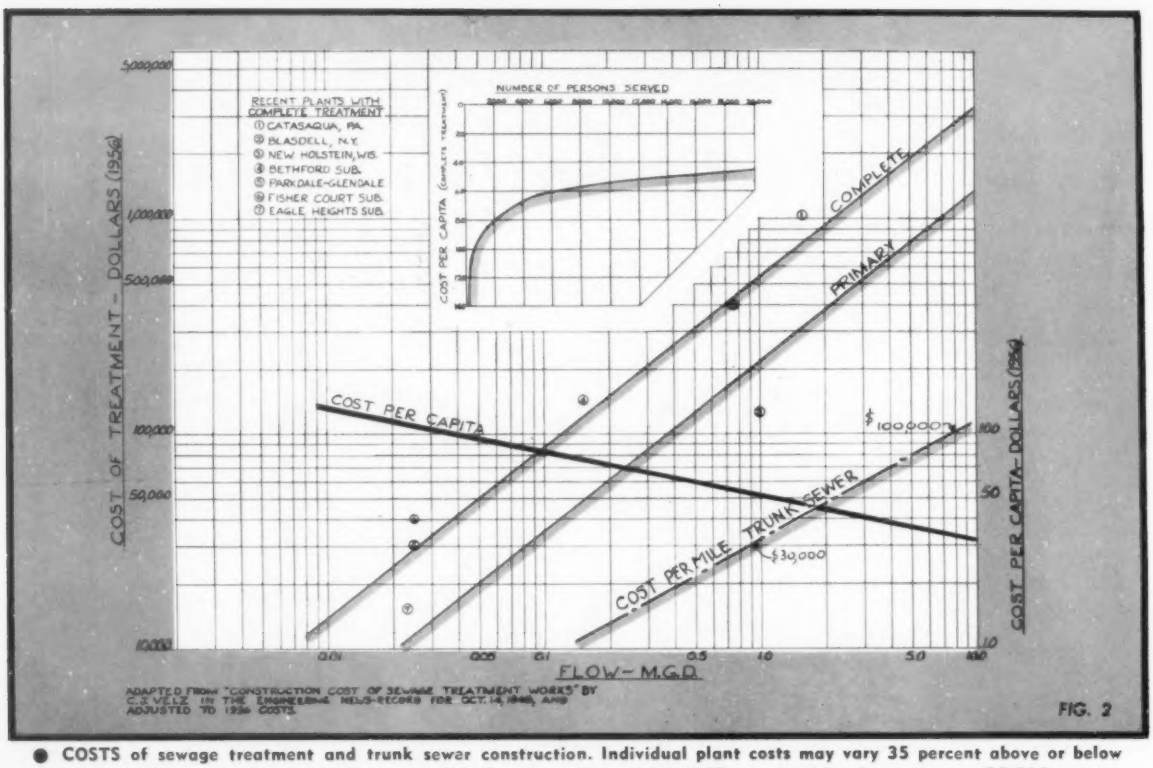
Figure 2 shows how the per capita cost of sewage treatment decreases as population served increases. It also demonstrates that sewage for a given population may usually be carried several miles via trunk sewer at less cost than is required to provide a separate treatment plant for it.

Under the town law little progress has been made since World War II in establishing sewer districts where they are needed, except for those serving limited areas. The outstanding need is for stage construction of trunk sewers and treatment works to serve large areas. These are very difficult for builders or small communities to furnish.

There are many engineering reasons why a drainage basin approach to sewer planning is desirable. At the same time the location and density of new neighborhoods is often a greater factor in determining the financial feasibility of providing public sewers than topography itself. Both drainage basins and neighborhood development often overlap municipal boundaries. These facts are true regardless of the type of governmental organization (county, village, town or authority) responsible for sewer construction and indicate that separate communities cannot successfully engage in long range planning because growth occurs with little regard for municipal limits.

When trunk sewers are provided for an area there seems to be a tendency for a large percentage of residential construction and industrial growth to occur in that area. Sewers, therefore, provide a tool through which government can guide new neighborhoods into the most desirable patterns. At present builders often seek the lowest cost land for housing, in part because no land with sewers is available. Such land is apt to be isolated from existing utilities. If builders will consult with planning and law enforcement agencies before purchasing development sites, much will be gained.

A wide scattering of subdivisions increases the difficulties of providing sewers and also renders it more difficult to provide such services as water supplies, roads, schools, and shopping areas. The automobile has made such scattered developments possible, but by no means makes them desirable from an economic or social point of view. Good planning should encourage gradual expansion outward from existing population centers. This will assist in maintaining full utilization of services which already exist and will


RECENT PLANTS WITH COMPLETE TREATMENT
① CATASAQUA, PA.
② BLASDELL, N.Y.
③ NEW HOLSTEIN, WIS.
④ BETHFORD SUB.
⑤ FAIRDALE-GLENDALE
⑥ FISHER COURT SUB.
⑦ EAGLE HEIGHTS SUB.
NUMBER OF PERSONS SERVED
COST PER CAPITA (COMPLETE TREATMENT)
COMPLETE
PRIMARY
COST PER CAPITA
$100,000
COST PER MILE TRUNK SEWER
$30,000
COST OF TREATMENT - DOLLARS (1956)
COST PER CAPITA - DOLLARS (1956)
FLOW - M.G.D.
ADAPTED FROM "CONSTRUCTION COST OF SEWAGE TREATMENT WORKS" BY C.J. VELZ IN THE ENGINEERING NEWS-RECORD FOR OCT. 14, 1948, AND ADJUSTED TO 1956 COSTS.
FIG. 2

● **COSTS of sewage treatment and trunk sewer construction. Individual plant costs may vary 35 percent above or below these plant values. As a basis for planning in Erie County, a flow of 1.0 MGD was considered to represent 10,000 persons.**

permit the residents of new housing to share in the benefits of present facilities instead of providing new facilities at today's high costs.

Sewers for each development are often regarded as separate entities, whereas they should be reviewed as part of a metropolitan whole. Approval of individual disposal systems for new homes may block plans for public sewers in the near future because new home owners who have paid for a private system costing an average of $700 will not be willing to participate in paying for public sewers. This is true even though the new homes are close to overflowing septic tanks used by older homes. In some cases the annual cost of private systems in Erie County exceeds $60 per year, if maintenance and depreciation are fully considered. Public sewers can usually be constructed in new areas for a lesser amount.

Without a master plan, sewerage for sub-divisions is bound to fail or be unsatisfactory. Planning officials can assist the development of superior neighborhoods and construction of sewers in many ways. These include:

1) Zoning land to prohibit housing developments at the present time in areas where the drainage is poor or where the location is such that the provision of utilities is costly or impractical.

2) Permitting smaller lot sizes where water and sewers are available. A 20 percent reduction in frontage and 40 percent reduction in area are recommended in such cases as long as acceptable minimum standards are not violated. There is widespread feeling that large lot requirements result in high class neighborhoods, but we are aware of instances where the opposite is true. Many factors aside from lot size enter into quality of new communities.

3) Approving lateral sewers and temporary sewage treatment plants in areas where construction of trunk sewers ultimately to service the area is underway. This is contingent upon streams having sufficient flow to receive effluent.

It is therefore highly desirable that planning officials and sanitary engineers work very closely together in the organization of utility services for suburban localities.

In many instances local officials are not anxious to encourage new housing projects because increased population will create a need for additional community services such as schools, water and sewers, with a resulting increase in tax rates. A study by the Housing and Home Finance Agency has indicated that it is not necessarily true that each new house results in an increase in municipal costs greater than the taxes received from that house. If new houses are constructed in areas which can be served by existing schools and by extension of utilities already in place, no increase in taxes may result. This is particularly true in the case of sewers. Spreading costs on the basis of use and benefit will also be of assistance in this problem.

In New York State the public health law requires that water and sewer plans for all sub-divisions be approved by the State or County Health Department. Plans for industrial and municipal waste discharges similarly must be approved. Such approval relates only to the prevention of nuisances or public health hazards from the specific development in question and bears little relation to questions of good planning or economics. The responsibility of County and Town Planning Boards is largely advisory. We, therefore, do not have in these two departments sufficient power to guide desirable community patterns or to assure compliance with a master plan for urban development.

Development of a metropolitan sewer plan should be of great as-

sistance in the correction of stream pollution conditions which affect most of New York State. Enforcement of the water pollution control act and local sanitary codes is often difficult because of local financial problems and the fact that the town law requires that volunteers take the initiative in formation of sewer districts. The cost of sewer service to individuals can be greatly reduced if a comprehensive system of trunk sewers and treatment plants can be provided since costs of major facilities can be spread over more users and greater valuation. It is not possible for individuals or small groups to provide such services on a voluntary basis without governmental backing. If major sewers can be laid before full development of a neighborhood occurs, substantial savings are possible.

In Erie County there have been many complaints since World War II by home builders, labor unions, the Chamber of Commerce and other groups that the lack of trunk sewers and treatment works was stalling the construction of much needed housing. This, in turn, handicaps industrial development because workers must have a place to live.

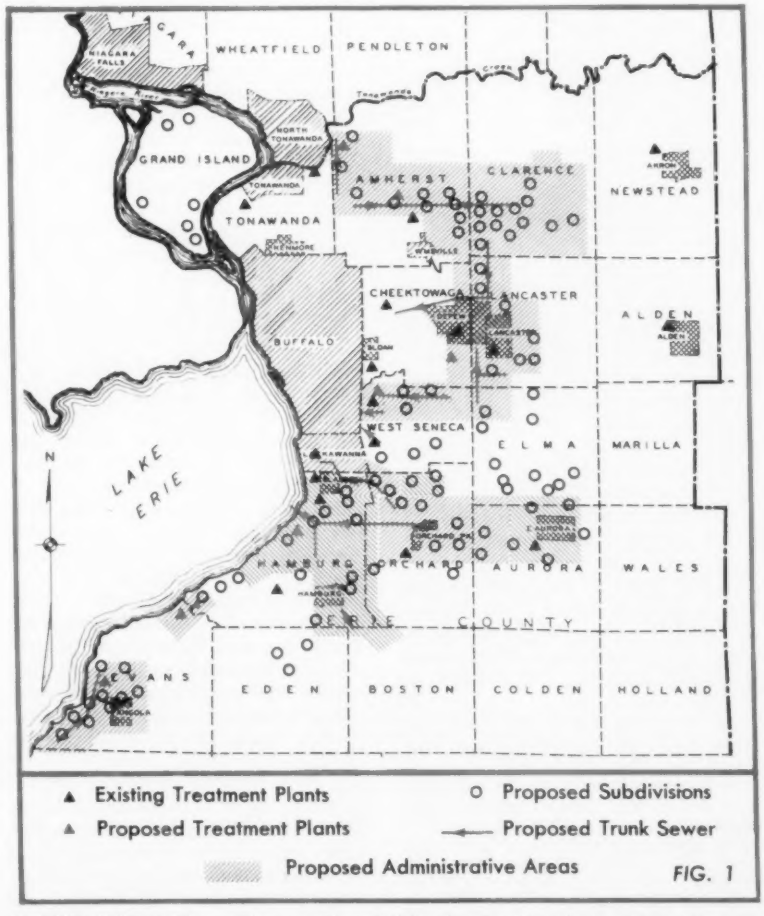
For these reasons the Erie County Board of Supervisors Survey Committee in 1954 appointed an Advisory Committee on Sewers which included members of many interested private groups, in addition to the Buffalo Sewer Authority, the County Health Department and the County Planning Board. This resulted in a study and report by a County staff to assist the Supervisors in deciding on what action, if any, the County should take on sewers. Following the completion of this report the Sewerage Advisory Committee made the following recommendations to the Board of Supervisors:

"The need for additional sewerage facilities and correction of water pollution in many parts of Erie County is serious. Progress under present procedures is often slow and unsatisfactory. In many cases the problem overlaps municipal boundaries, and better and more economical solutions may be secured by inter-municipal action. Lower units costs for trunk sewers and treatment plants may be secured by systems serving a considerable area, rather than by numerous small independent and unrelated systems.

"It is evident that an administrative unit with authority to plan and coordinate sewerage improvements throughout expanding portions of the County is needed. It should be organized to facilitate more effective measures for construction of sewers and treatment works than are now available. It is, therefore, recommended that the Erie County Board of Supervisors establish a County Sewer Agency under Article 5B of the County Law. By this action machinery can be made available for a coordinated approach to sewerage problems for those municipalities electing to use it. Actual charges for any construction projects undertaken, including the cost of construction plans and specifications, would be limited solely to the areas benefited. In addition to processing any County Sewer Districts which develop the County Agency would render a continuing advisory and coordinating service to local municipalities in the solution of their sewerage problems and correction of Water Pollution."

A sewer agency was created in the spring of 1957 and a staff was provided toward the end of that year. Preparation of plans for sewer systems to serve four municipalities is in progress. Under the New York State Law, county agencies may be organized for the purpose of providing water, sewers, or drainage facilities and may permit municipalities within a county to engage in cooperative large scale planning and construction if they choose to do so. All construction costs are carried by the area benefited rather than the entire county. This permits the work to be concentrated in the area having a real need. A metropolitan solution is made possible without infringement of local home rule. The agency may also prepare master plans for sewers and treatment throughout the county for consideration by local municipalities.

County districts are established by the Board of Supervisors following a public hearing and an opportunity for residents for the area concerned to vote in a referendum if desired. Each county district when established may be administered by a board representing the municipalities within it. County bonds may be utilized for financing. In addition to Erie County in New York, Monroe, Chemung, and Tompkins counties are giving consideration to organizing county sewer districts.



● THIS MAP of the northern portion of Erie County, New York, shows the complexity of providing adequate sewerage facilities for scattered subdivisions. Some trunk sewers will connect to existing plants; but new plants will be required too.

the MARKET for TAX-EXEMPT BONDS

HARRY L. SEVERSON
Financial Economist and Bond Analyst

THE FINANCING of the expanded services which the growing population and the increased tempo of the times are requiring of state and local governments presents challenging problems. For most governments these problems will become increasingly difficult in the years ahead. The most spectacular, although not necessarily the most important, of the demands being made upon state and local governments arise from the inadequacies of their capital facilities. Traditionally state and local governments have financed a considerable proportion of the cost of large capital improvements by borrowing, and there is every reason to anticipate that this will continue to be the case.

The unique characteristic of state and local bonds—tax exemption—is well known. In the past two decades this type of investment has commanded a decidedly better price (lower yield) than other investments of similar quality and maturity. At times the demand for tax exemption has been large in relation to supply. During World War II, and in the period immediately following, investors in the high income tax brackets were so anxious to obtain tax-exempt bonds that they were very aggressive in searching them out. Under these circumstances issuers were in an extremely advantageous position in the bargaining. The objections of one group of potential investors were not necessarily serious as there was likely to be another group willing to purchase the bonds at little if any concession in price.

In the years which followed the close of the war, the volume of new offerings increased faster than the accounts which benefit so much by tax exemption. As tax exempt bonds have become plentiful, investors have become more selective, with the result that the issuers are finding themselves in a less advantageous position. Furthermore, the more rapid pace at which new issues are expected to be offered in the years immediately ahead will cause this trend to continue, except to the extent that the issuers are successful in developing new markets.

The Municipal Bond Market

There are numerous facets to the market for tax-exempt bonds which must be considered in formulating and administering a financial plan. In preparing their bid underwriters consider carefully the probable acceptance of the new issue by the public, and one of the first steps in this is a review of the record of the issuers' outstanding bonds in the secondary market.

Looked at broadly the market for state and local bonds appears to be very competitive. The gross profit per bond is typically very small. Looked at more closely, however, the market takes on a somewhat different appearance. Actually there is not one market but countless markets in which the thousands of issues are traded. These markets are competitive in varying degrees. Some bonds are distributed locally; others regionally; and a relatively few nationally. When a local market becomes saturated and it becomes necessary to find wider outlets, price concessions which seem rather sharp are likely to be necessary unless the issuer has had the foresight to cultivate additional markets in advance. The same is, of course, true when it becomes necessary to move from a regional to a national market.

The Interest Rate Curve

An issue of tax-exempt bonds is likely to be offered in many maturities. Consequently conditions in both the money and capital markets must be considered in planning and scheduling the sale of a new issue. For the past twenty years, short maturities have sold on a lower yield basis than long maturities. When money is relatively easy, (a situation which prevailed during much of this period) the difference in favor of short maturities is substantial. This is due to the fact that commercial banks which are large buyers of state and local bonds tend to concentrate their purchases in the early maturities. When banks have excess reserves they are likely to buy heavily forcing the prices of short-term issues up both in absolute terms and in relation to long-term bonds. When reserves are short the opposite situation obtains. Banks take care of their regular customers first, which leaves only a limited amount of funds with which to buy bonds, and certain banks may even sell some bonds to improve their reserve position. This causes the interest rate curve to flatten out. Thus, while the pattern of a low yield on a one-year bond with a step up each year at a declining rate until the curve becomes almost flat obtains so much of the time that we are likely to regard it as normal, long-term plans should not be based upon the assumption that this interest rate pattern will always obtain. In drafting bond laws and formulating financial plans recognition should be given to the fact that the level of interest rates fluctuate, and the relationship between maturities also changes.

Factors Affecting Price

The price at which a particular issue will sell is affected by many economic and political forces. Over some of these the issuers have no control and must adjust to conditions as they find them; over others they can exert influence collectively; and over still others it is the policies of the particular issuer which largely control. For purposes of discussion the factors affecting the price of a new bond issue will be grouped together into three broad categories (1) conditions in the money and capital markets; (2) the market value of tax exemption; and (3) the acceptance of the particular issue by the investors.

Conditions in the capital markets: Fluctuations in interest rates are re-

In preparing this and other articles the writer has drawn heavily upon Chatters and Hillhouse "Local Government Debt Administration" (Prentice-Hall 1939). Although this book was written about twenty years ago in an economic environment very different from that which obtains today the major problems of debt administration are clearly stated and much of the discussion still sounds fresh.

garded as important indicators of the changing business scene and are widely reported in the public press. Shifts in Federal Reserve policy are quickly transferred to the municipal market through the changes in the investment policy of commercial banks. Also the interest rates which dealers must pay on their loans to carry inventory affect their willingness to bid on new offerings. Obviously there is nothing an issuer can do to influence the general level of interest rates. Financial officials of state and local governments must adjust their programs to meet conditions in the money and capital markets as they find them.

The market value of tax exemption: As the accounts which benefit so largely from tax exemption have filled up over the past ten years there has been a reduction in the value of tax exemption to state and local governments. This erosion will continue except insofar as the issuers find a way to tap some of the pools of savings which are accumulating in financial institutions which do not now benefit very much from tax exemption.

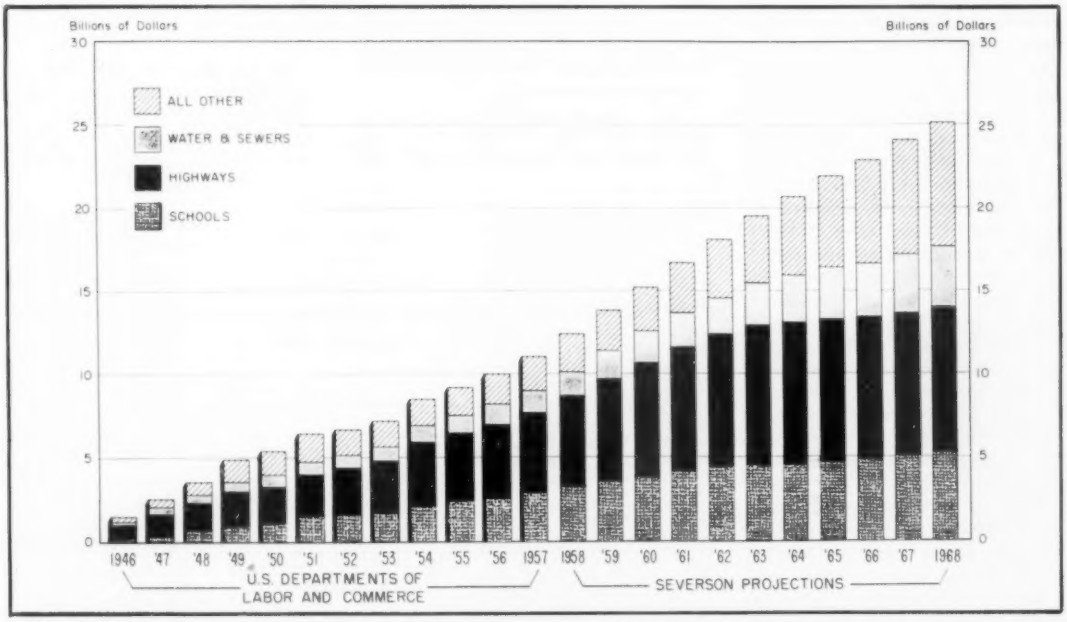
One very simple method of attracting more buyers for state and local bonds would be the enactment of the "pass through" which would allow investment companies to purchase these bonds and pass the interest to their shareholders without the loss of its tax-exempt status. In the broad form, such as embodied in HR 8702, this would greatly increase the market thereby resulting in more favorable interest rates for issuers of such bonds.

Acceptance by the investors: Any one or a combination of a number of causes may account for the wide variations in the price at which various offerings sell. A bid which appears poor may be due to the fact that the issuer has a bad name, since the market has a long memory for sharp dealing. The issuer may not be well known in this market. The timing of a particular issue may be unfortunate—the market may be overloaded with this type of security. The issue may be poorly set-up, or the market may judge the credit quality adversely. These are things over which the responsible officials, past as well as present, have exerted great influence.

The preparation of an issue which will receive a high bid may be made difficult by rigidities over which the present management has little control. Pledges made in earlier indentures may present serious hurdles. Restrictions in state laws on debt or tax limitation of many sorts may also present difficulties. In certain cases it appears that more taxing resources must be allocated to the local governments which have heavy responsibilities if credit quality is to be maintained. Wherever possible a direct attack on these restrictions is to be preferred. Although evasions by various means are sometimes possible, they are likely to be expensive. An incidental but important by-product of the type of financial planning advocated in these articles is that it will provide local officials with material on which to recommend legislative changes.

With the total supply of tax-exempt bonds showing a tendency to increase more rapidly than the demand, it becomes necessary to plan each issue with the current preferences of investors in mind. Although it is essential that an offering be processed quickly once the decision has been made to request bids there is no reason why the preliminary work cannot be done in advance so that each provision of the indenture can be given thoughtful consideration.

Officials who are anxious to maintain a high credit standing will take all possible steps to build up the economic base of the comunity. It is well recognized that only a prosperous community can issue high-grade bonds. Appropriate measures for improving the economic base will vary with the type of community, but in most cases it will involve cooperation with the business enterprises domiciled in the area. Care must be taken that the new taxes required to finance the added improvements are not levied in a way which will undermine the economic base. On the other hand it must be recognized that the failure to install needed public improvements may cause business to shun an area, thus weakening the economic base of the community.



● **CONSTRUCTION expenditures of state and local governments, 1946-1957, with projections by the author to 1968.**

SPECIAL CONNECTING STRUCTURES in SEWER WORK

Head is saved in the line by enlarging the diameter, but in the manhole it is done by attention to details

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Civil Engineer
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EVERY COMPLETE SET of plans and specifications for sewer construction includes drawings of standard manholes, which are the ordinary and usual connecting structure utilized in such work. Good practice dictates that the manholes be located at every change in size of sewer; at every change in grade or in horizontal direction; at every junction of lines; and also at some maximum interval, selected so that cleaning is practical. In connecting the smaller pipes the base of the manhole usually is set at such a level that the lowest pipe lies imbedded in the concrete of the bottom, and this pipe is broken out over its upper portion. If there is a direction change at the manhole, the concrete of the bottom is shaped smoothly to conform to the bend, and the sewage, if not flowing too rapidly or too full in the pipes, tends to conform to this bend in its passage through the manhole. If the lines joining at the manhole are at different levels, short drops are often handled by direct openings above the bottom, and longer drops are carried down in a stack to make a drop manhole.

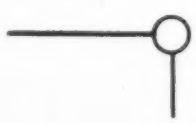
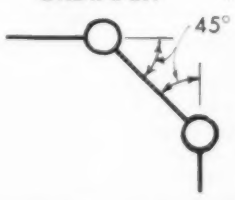
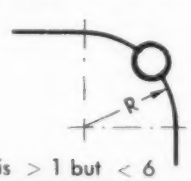
Special Connecting Structures

In this discussion a special connecting structure means one that has been subject to design analysis. It may be formed on the site by reinforced concrete, or by the equivalent assembly of present units if and when any such become available; or it may be a combination or modification of the standard types.

Where the fall of the ground is sufficient to establish flow at average to maximum allowable velocities and there is head to be wasted, special manholes to economize on head loss are not indicated. This discussion is confined to the opposite situation in which the natural fall of the ground along the desired sewer route is barely sufficient, or is insufficient, so that velocity somewhere in the system is not fully adequate, or ultimately the pipe lines are set unduly low in the ground and the flow has to be pumped up in order to reach the discharge level without excessive surcharging upstream.

Where no excess fall is available, design may be controlled by the minimum allowable velocity and pipe sizes selected accordingly. This economizes on the slope; the expenditure of fall per foot by the pipe used is comparatively small. The expenditure of dollars, however, increases; the greater the length of pipe used per foot of fall, the greater the cost per foot of both pipe and fall.

Saving head in manholes may be justified in either of two ways, depending upon circumstances: 1) The head which is saved may permit use of a smaller size pipe and a reduc-

Loss Estimates for Small Size Pipe*	*Schematic Diagrams of Manhole Construction*	*Loss Estimates* for Large Size Pipe*
Loss Probably Not Over $1\frac{1}{2}h_v$	ORDINARY 	Loss Probably Not Less Than $1\frac{1}{4}h_v$
Loss Not Over $3h_v$	MODIFICATION OF ORDINARY 	Loss Probably Not Over $\frac{1}{2}h_v$
Loss Probably Not Over $1\frac{1}{2}h_v$	MONOLITHIC DESIGN  R/D is > 1 but < 6 D = Pipe Diam.	Loss Probably Not Over $\frac{1}{4}h_v$

**Note—All pipes are assumed full or surcharged*

Table 1

tion in the total cost of construction may result; or 2) by utilization of the saved head, more feet of pipe may be built and thus a disposal point may be reached without construction of a pumping station. The value of the saved head may be determined by comparing the additional cost of the changed manhole with the construction cost for the length of pipe that will use up the head, the inference being that the additional manhole construction is worth while if its cost is considerably less than that of the pipe. This is not intended to be in any way a substitute for the usual complete comparison of the capitalized costs of otherwise satisfactory alternate schemes.

Manhole Classifications

For the purposes of this discussion the situations at a bend manhole are classified into six different types. As shown in Table 1 these are listed as ordinary (entering flow at right angles to leaving flow); modification of ordinary; and monolithic design. Each is further divided into small size pipe and large size pipe.

The terms small and large are defined by comparison of the inside pipe diameter with the inside dimension of the manhole. Most manholes have an inside diameter of 4 feet. Discharge from a 12-inch pipe flowing full, with only its bottom channeled into the bottom of a manhole, will expand considerably in the increased area of the manhole and will contact again when leaving, especially if the pipe flow is under pressure. As progressively larger pipes are considered, the effect of sudden expansion due to the increased area of flow in the manhole and the sudden contraction into the outlet pipe becomes less and less until finally the 4-foot inside diameter manhole becomes little more than an opening at the top or alongside of a very large conduit. The greater the expansion and contraction, the greater the loss from that account.

Large Size Pipe

As shown in Table 1 for the large size pipes, the loss in an abrupt right angle bend is probably not less than $1\frac{1}{4}\ h_v$. As is customary, h_v represents the velocity head and is equal to $v^2/2g$. Velocity is a vector quantity, and the velocity head in the original direction, h_v, has no component at all in the new direction. Also, as the entrance loss for a sharp cornered opening is $\frac{1}{2}h_v$, we may consider the reentrance loss to be not less than $\frac{1}{4}h_v$. These total $1\frac{1}{4}h_v$. In other words the velocity head in the entering pipe is lost in turbulence, and the pressure build up in the manhole in order to leave is $1\frac{1}{4}$ times the velocity head in the outlet pipe.

A modification consists of two ordinary manholes so placed that the angular change in the direction of flow is 45 degrees in each. Tests on smooth pipes indicate that the total loss in such a system is probably not over $\frac{1}{2}h_v$. Other tests on smooth pipes show that the loss in a smooth bend of radius about 4 times the pipe diameter will not be over $\frac{1}{4}h_v$, which is the loss shown in Table 1 for large size monolithic design, although it may be much less.

Small Size Pipe

Manholes to connect small size pipes meeting at angles should feature the pipes set almost entirely in the bottom of the manhole and joined therein by a channel that is curved smoothly to lead the incoming flow into the direction in which it is to leave. When the lines are not surcharged, such design will result in a head loss of substantially less than one h_v. This is much less than if the incoming pipe inverts simply rested on a flat bottom, in which case the solids would tend to settle in the manhole and be a nuisance.

No matter how deeply the small size pipe is imbedded in the manhole, and no matter how well rounded the right angle bend is formed in the bottom of the manhole, the top will always be broken out so that when the pipes flow full, the liquid will expand in area into the manhole. There will be some loss due to this expansion and the following contraction. When the sewer is full a slight extra flow will cause surcharging, whereupon regardless of the excellence of the construction, the result in the small sizes still is flow from a small cross-section (that of a 6 or 8 or 12-inch pipe) through a varying cross-section of manhole, being at its maximum a rectangle four feet wide with a height equal to the depth of liquid in the manhole, and then out another small round opening. There will be channelization of flow and turbulence.

Table 2—Typical Costs Based on Average Depth of Installation

42-in. R. C. Pipe	$26 per foot
48-in. " "	31 per foot
54-in. " "	35 per foot
60-in. " "	39 per foot
66-in. " "	43 per foot
72-in. " "	47 per foot
78-in. " "	51 per foot
84-in. " "	57 per foot
Manhole	$500 each

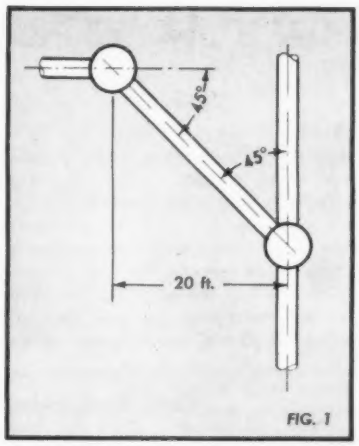


FIG. 1

● **MODIFIED arrangement uses 8.3 ft. more pipe than does a 90° connection.**

In Table 1 the tabulated loss estimates for small size pipes are based on surcharged conditions. Under this condition the losses in small pipes are more severe than at any time in large lines where the manhole is more of an opening in the pipe than a sudden enlargement. Because of expansion losses, the modified and monolithic designs recommended for the larger lines are of no benefit with small lines. In fact, modified design leads to one extra expansion and an additional head loss; and monolithic design, again because of sudden expansion, could lead to a loss about equal to that experienced in ordinary design. The losses in Table 1 are assumed maximums, and are based on flow into a manhole so full that the velocity therein is negligible. As a result the direction of leaving has no further detrimental effect, even when 90 degrees from that of entrance. In each manhole the entrance loss is $\frac{1}{2}h_v$ in the exiting pipe.

Costs

Table 2 is a listing of costs of different items as employed in the computations of this article. For any community the economic justification of special manhole structures should be worked out using the proper costs for the component parts. Recent local contracts should be examined and an average taken of the price paid for each item, with due weight being given to the quantity involved and to special cir-

cumstances in order to avoid the influence of any unbalanced bid item.

Savings

Table 3 presents data on four large size round pipes, each with a slope equal to .001. *Column 1* is the velocity in the pipe flowing full, in feet per second, and is obtained from a Manning's formula diagram with *n* equal to .012.

Column 2 is the quantity in cubic feet per second in the pipe flowing full at the given velocity, and is the product of Column 1 and the pipe area in square feet.

Column 3 shows the velocity head in feet, matching the velocity of Column 1.

Column 4 gives the length of pipe in feet which will use up in friction the amount of head equivalent to that saved by the modified manhole as compared to the ordinary right angle manhole construction. This is ¾ of h_v divided by the slope, s_1. Without the modified manhole construction this head would not be available for use.

Column 5 is the cost of the modified manhole construction over and above the ordinary manhole construction cost. By reference to Figure 1 it will be noted that the length of pipe between the two manholes is longer than it would be if the lines came together at right angles in one manhole. This distance is 20 times the secant of 45° minus 20 and is equal to 8.3 feet. Assumed costs are listed in Table 2.

Column 6 shows the slope, taken from Manning's formula diagram with *n* equal to .012 which would be required to carry the flow in Column 2 in a pipe 6 inches smaller than the one under consideration.

Column 7 lists the distance in feet along which the smaller pipe may replace the larger by utilization of the saving in head of the modified manhole construction. This equals ¾ of Column 3 divided by the difference in slopes, $s_2 - s_1$.

Column 8 shows the gross savings in dollars of this constructed length, and is Column 7 multiplied by the difference in cost per foot of the original pipe size under consideration and a pipe 6 inches smaller. Pipe costs are from Table 2.

Column 9 is the net saving, Column 8 less the extra cost of the modified manhole, Column 5.

It may be demonstrated that for any given size of large pipe, the potential or actual saving in dollars commensurate with the preservation of any multiple of h_v by a special manhole is quite independent of slope. This can be proved by Manning's formula, v equals 1.486/n times R times $s^{1/2}$. For a given pipe size, v is proportional to $s^{1/2}$. As h_v is proportional to v^2, h_v is proportional to s, and h_v/s is constant, regardless of pipe diameter.

Table 3 strongly indicates that it is going to be cheaper with the larger sizes to save a foot of head for useful purposes in the manhole, rather than to save it in the pipeline. Notice from Column 4 how comparatively long a length of additional pipe could be laid by use of the head saved. The relatively small extra manhole cost is tabulated in Column 5. For comparison, note from Column 9 the net construction cost saving that results if the head saved by the modified manhole is expended in a pipe (length shown in Column 7) that is six inches smaller than the original in diameter, and replaces the original.

If the bend were poured monolithic or otherwise made smooth, with the radius of the bend from one to six times the diameter of the pipe, and there was but one opening or manhole, the loss therein might not be over ¼h_v. Then the gross and net savings (although the cost of this bend and manhole may be greater than that of the modified bend with two manholes) are likely to be still greater. The numerical values in Columns 4, 7, and 8 of Table 3 may be increased by 1/3 to give the corresponding values for this case, a total saving of one h_v. Columns 5 and 9 would also change. Standard precast manhole sections could be used over the top of the pipe.

Use of Models

Models could show the losses precisely for each of the six cases estimated in Table 1. Model tests could be particularly helpful in indicating economical construction for pipe sizes next smaller than those detailed in this article, because for them manhole losses appear to be comparatively large, and yet are not entirely due to the sudden expansion followed by sudden contraction to be expected with 8 or 12-inch pipe. If the money could be found to set up and make the tests, and publish the results, the application of the findings might result in a notable savings for the public. The different factors that come into play in causing losses, comparing small pipe sizes with large, are the reasons why some cities have rules that above certain sizes, all bends are to be poured monolithic. This practice is perhaps not as widespread as it should be, and usually is not based on accurate tests.

In this day and age, there still seems to be a tremendous gap between what is taught and worked out in schools of higher education and in associated laboratories, and what is used in practice. To the initiated there must be many examples of "penny wise and pound foolish" connecting structures. Model tests could indicate the feasibility and advantages of special connecting structures and should at least pay for themselves when such a service becomes in demand and commonplace.

Table 3—Computation of Savings Resulting from Use of Modified Manholes

Slope, $s_1 = .001$

Pipe Dia. d, inches	Col. 1 v	Col. 2 Q	Col. 3 h_v	Col. 4 $\frac{3}{4}\frac{h_v}{s_1}$	Col. 5 \$500 + 8.3a	Col. 6 s_2 (slope for pipe d−6 in.)	Col. 7 $\frac{3}{4}\frac{h_v}{(s_2-s_1)}$	Col. 8 Col. 7 times (a−b)	Col. 9 Col. 8 minus Col. 5
48	3.9	50	.237	178	\$757	.00204	171	\$855	\$98
60	4.55	90	.322	242	\$824	.00170	346	\$1384	\$560
72	5.1	148	.404	303	\$890	.00159	514	\$2060	\$1170
84	5.69	219	.505	378	\$973	.00149	775	\$4644	\$3670

a = cost per foot for pipe of diameter "d"
b = cost per foot for pipe of diameter "d" minus 6 inches

APPLICATIONS OF THE DIGITAL COMPUTER TO RESERVOIR YIELD STUDIES

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ONE OF THE MOST important steps in reservoir planning and design is the determination of how much water the reservoir can be depended upon to yield during critical drouth periods. In the past, engineers have predicted the dependable yield by a time-honored system of step-by-step manual calculation, approximating what would have happened if the project had been operating during the worst drouth on record. This is a tedious procedure. Although the results are very important and although the studies themselves require a certain amount of experience and insight, they are not the kind of thing that an engineer enjoys working on. Using a good desk calculator, one man can complete only about 25 years of yield study work each day, if the calculations are in one-month steps; and extensive yield investigation can easily involve many man-days, or weeks, or even months of computational drudgery.

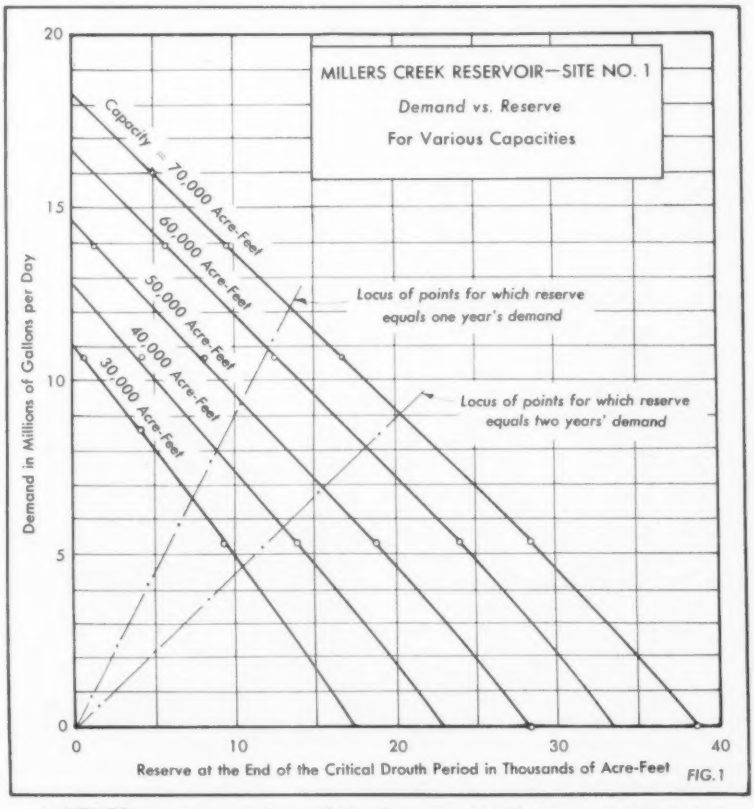
This is an obvious application for digital computers. The mathematics involved are simple and repetitive. Calculations which a man takes an hour to complete with a desk calculator can be done by a computer in seconds. In contrast to a manual procedure that is slow, costly, subject to careless mistakes and deadly to an engineer's morale, the computer approach is incomparably faster, far less expensive, very reliable and, perhaps most important, exciting to use.

Some Uses of Computers

An excellent example of the advantages of the new method is the Master Plan Study for the Nueces River Basin, for which an exhaustive analysis of reservoir performance characteristics was recently completed by digital computer. The machine used in this case was an IBM Type 650, at the Datics Corporation's computing service installation in Fort Worth. The study involved the existing Wesley E. Seale Reservoir, which supplies water to the Corpus Christi area, and seven other potential reservoir sites on a watershed of over 17,000 square miles. Not only was it desired to define the potentialities of each site individually, but it was also necessary to establish the best combination of projects for eventual optimum use of the waters of the Nueces Basin.

Without the computer, this would have been a staggering job. There are 255 possible different combinations of one or more of eight reservoirs, without considering variations in reservoir capacity at each site. No two of these combinations would be likely to give exactly the same total yield. Even the basic stream flow data would differ from one combination to the next, since the upstream sites withhold water which otherwise would be available to projects further down the river. When variations in reservoir capacity are considered, the problem is literally without limit. Even after the scope of the study had been greatly simplified by preliminary limitations based on engineering judgment, it was still obvious that the most basic portion of the analysis, alone, would require from nine to twelve man-months by the manual method.

Use of the computer avoided this very serious delay in completing the essential mathematical background



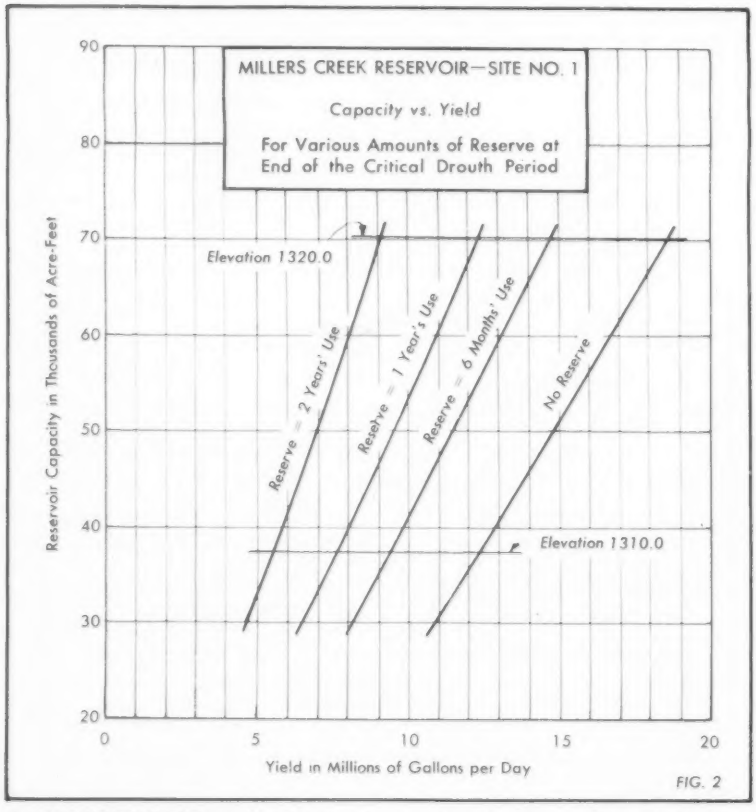
● **USE OF computer permits quick development of yield characteristics of site.**

for the study. In all, the total computer time was something less than four days, applied in short increments over a period of a few months. Probably more important for the quality of the study, however, was the fact that, by turning the numerical work over to the machine, it was possible to expand the scope of the investigation and to have thorough computational coverage wherever needed, rather than the skeleton program of calculated values which would have taken nearly a year to achieve by hand. The importance of this cannot be stated too strongly, for the study was greatly improved by not having to skimp on computations. Quite apart from the question of being able to get the work done on time, good engineering must be thorough, and gruelling sessions with a desk calculator are hardly conducive to thoroughness.

Smaller Problems

The Nueces study was a large project, but it has also been found that the computer can be used to advantage in small investigations. For example, by using the same machine it is relatively easy to develop a plot (Figure 1) of the complete yield characteristics of a small reservoir site. From this diagram, it is possible to read almost any desired information about the yield of the site, such as: 1) What the dependable yield will be if the reservoir is constructed to have any given capacity; 2) what the dependable yield will be after the initial capacity is decreased by siltation; 3) what the dependable yield will be if a given amount of water is kept in storage at all times, as a factor of safety; and 4) how much the dependable yield can be increased by successive additions to capacity.

The information in Figure 1 can also be presented in several other forms, each placing primary emphasis on a different aspect of the reservoir's behavior. Figure 2 is an example of this; it was developed from the same original data and supported by interpolation from Figure 1. Although both graphs actually show the same thing, each is distinctly preferable for certain uses. Plotting the answers from several viewpoints, in this manner, helps to fill in questionable areas on all of the graphs and adds considerably to the value of the results.



● **CAPACITY-YIELD study shows reserve water in storage for critical drouth periods. This uses same data as Fig. 1, but shows a different reservoir behavior.**

The total expense of the complete coverage by computer is usually significantly less (about 50 percent less in the case of the Nueces Study) than would normally be incurred in manual calculations to arrive at only the most essential portion of the problem's solution.

Details of the Method

Although engineers in general do not realize it, it is no longer necessary for a man to have detailed knowledge of computers in order to use them. In the past year or two, the computer field has seen the emergence of a new type of firm, the computation service, whose purpose is not to sell computers but to use them in solving problems for anyone who has problems to solve. This service is almost as valuable to an engineer who knows nothing about the machines as it is to one who has been familiar with them for years. If he thoroughly understands the technical side of his problem and can explain it to the computation service's experts, they can furnish the skills in mathematics and computer techniques which are needed to create a working program.

For example, the yield study program mentioned here resulted from the joint efforts of a hydraulic engineer, who knew about yield studies, and a computer expert who knew the machine. At the start, neither of these men knew much about the other's part of the task, but by combining their special skills they were able to produce a good program.

Once the yield study program was set up in the computer, the following information, punched on IBM cards, was fed in as data for each solution: 1) The code number of the run; 2) the capacity of the reservoir; 3) the amount of water in storage at the start of the run; 4) the coefficients and exponents of a polynomial expression,

$$a + bx + cx^2 + dx^3 = y,$$

which defined the reservoir surface area (y) in terms of the amount of water in storage (x), an expression developed from the reservoir's area-capacity curve by means of a separate computer program; 5) a schedule of monthly water demands, set up according to the anticipated pattern of seasonal variation in water use: 6) gross evaporation and effective rainfall on the lake surfaces for each month; and 7) monthly runoff values.

Basically, the program works with the fundamental water-balance relation which applies to all yield

(*Continued on page* 180)

● ROTARY plow removing snow from cut section where heavy drifting has occurred. The first pass is the hardest.

WINTER MAINTENANCE

on Maryland Highways

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Maryland State Roads Commission,
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BEFORE DISCUSSING the subject of winter maintenance operations, perhaps it would be well to describe briefly the terrain in which our Department operates.

"America in Miniature" best describes the state of Maryland. From the Appalachian Mountain peaks to its Atlantic Ocean beaches, its network of safe and modern highways, divided for maintenance purposes into seven districts, comprises approximately 4,700 miles, 313 miles of which are dual highways. In an area of 10,500 square miles, there is a population of 2,343,000. It is geographically located in the North Atlantic states group and its system of highways carries, in addition to its heavy concentrations of local traffic, the tremendous volume of motorists traveling north and south along the eastern seaboard.

To provide more protection for these visiting, as well as local, motorists the Maryland State Roads Commission, during the winter of 1957-58, joined the highway departments of sister states in accelerating maintenance operations so as to minimize the economic loss by providing safer highways during periods of snow and sleet storms.

It is the intent of this article to outline our preparations, indicate the problems and experiences encountered during the first winter of a program of "bare pavement" maintenance on 1,600 miles of the heavier traveled roads, in addition to accelerating our operations so as to reduce the hazards of winter driving on the remaining mileage.

Preparation

Procedures and results made available to us, in pamphlet form, from cities and states located in the so-called "snow-belt" area, indicated that rock salt, of the cc grade, due to its initial cost and effectiveness, was the chief material weapon used by them in similar programs.

Courtesy Tarrant Mfg. Co.

● SALT is normally spread in a 4 to 6-ft. width on the crown of the road.

Consequently, our first step was to determine the best methods of obtaining, storing and applying this material. After comparing prices, bag versus bulk, truck versus rail, it was decided that we would avail ourselves, wherever possible, of the apparent considerable savings by using salt in bulk, and rail shipments. It was felt that the protection of salt in transit was desirable; consequently, our invitations to bid required that the material be delivered in covered hopper bottom or box cars.

Our initial expenditure, of approximately $80,000, was for the purchase and erection of four 160-cubic yard steel storage bins with under-track screw and elevating conveyor, located strategically, at rail points, along the heavier traveled highways.

Additional one-way, V and wing type plows and spreaders, both large and small, were purchased so that each of the approximate 400 truck units, owned and operated by this Department, was equipped with a spreader in addition to a snow plow. One complete "Sno-go" unit was added to the two purchased several years ago.

During the fall of 1957, each District Engineer negotiated with the owners of equipment adaptable for snow removal, as to rental rates of equipment and operators, so that in emergencies this equipment would

● **SNOW FENCE** on snow fence: Here the third layer of snow fence is placed on top of two previous fences, now covered.

● **FENCE** shown at left has helped. With it and with application of salt, bare pavement has been provided for motorists.

be ready to move along with that owned by this Department.

An advanced warning system, direct teletype communication between the U. S. Weather Bureau located at Friendship Airport, just south of Baltimore, and the headquarters office was established.

This Department, although not equipped with its own radio system and having been forewarned as to the importance of this type of communication, requested assistance of the State Police radio network during periods of emergency. In addition, 18 units, comprising our weighing crews, equipped with radios operating on the police band, were assigned to the various Districts.

Meetings of the maintenance supervisory personnel were held at which time experienced representatives from the various equipment and material companies instructed our men in methods and procedures which they have found to be most effective in winter maintenance operations.

During the month of October, the maintenance crews were engaged in erecting 2,200,000 feet of the standard type picket snow fence. In connection with this phase of winter operations this Department is, at the present time, engaged in locating sites for the planting of evergreens, to function as live snow fence.

Problems & Experiences

The time spent in preparation has paid large dividends. The first general storm of the season, approximately ten inches in depth, struck during the early part of December. Fortunately, our first deliveries of salt were just being unloaded and the newly purchased equipment was being attached to assigned units. Consequently, at the outset, our personnel were able to present full strength when combatting a storm extremely severe for this area.

In fact, the entire winter of 1957-58 has been a series of storms of varying types and intensities. Reports from the U. S. Weather Bureau indicate that this past winter has been the most severe, for this area, since the turn of the century.

Total inches of snowfall and number of storms as recorded at the U. S. Weather Bureau, Friendship Airport, Baltimore, are as follows: November had a trace of snow; in December there were 3 storms for a total of 9½ ins.; January had 2 storms for a total of 1½ ins.; February had 18½ ins. in 3 storms; and in March there were 7 storms that totaled 13 2/3 ins.

This tabulation, however, does not give the varying depths of snowfall in other sections of the state. It is worthy of comment that the maintenance organization of Garrett, our mountainous county, has been constantly engaged in snow removal operations since early in November. To date, the accumulation of snow has totaled 150 inches in this county. In Cecil county, our northeastern extremity, there has been a measured total depth of snow of 76½ inches.

The freakishness of this winter's storms is indicated by the fact that on January 24th, the southeastern extremity of our state received a 10-inch snowfall while the Baltimore area received only a trace. The Weather Bureau noted a total of 8.2 inches of snow accumulation for the storm of March 19th, whereas

● **ONE ROW** of fence erected on top of snow to catch another layer of snow. Highway at left is Route 46, near state line.

● **ONE OF** the deepest drifts the author has ever seen. It was 13 ft. deep. Location: On US 219 just north of the Cove.

within a few miles to the north of Baltimore, and also a few miles to the south of the airport, there was a measured accumulation of 20 to 24 inches. Had the temperatures been a few degrees lower and the precipitation, at the beginning of the storm, been snow instead of rain, the accumulated depth of snow could have very easily broken all records for this area.

As to varying types of storms, I would like to make a comparison of two, one in February and one in March. On February 15th, 15½ inches of snow fell in the Baltimore area, with varying depths in the other parts of the state. This storm, accompanied by lowering temperatures and high winds, together with the heavy traffic demands, presented the greatest challenge which our maintenance organization has ever encountered. No set pattern of operation could be followed. It was simply a case of breaking through heavy drifts occurring on some of our secondary roads, which had not as yet been brought to desirable standards. The high winds closed many of these roads as fast as we could open them. Consequently, it was an around-the-clock problem for the first several days, until the winds abated. The only way that we could make any progress against the results of the storm was to supplement our own equipment with all types of heavy equipment, and with operators made available to us by contractors as previously arranged.

This equipment, together with the untiring loyalty displayed by our maintenance organization who, even under the most adverse conditions, gave freely of their services for prolonged periods, was responsible for the reflected comments of the press and public which bore adequate testimony of the success of their efforts.

The storm of March 19th presented an entirely different problem. It struck with the temperature at 32°, which temperature remained firm throughout the duration of the storm. The depth of the snowfall generally equalled or surpassed that of the February storm. The snow, being wet, did not drift, and as a consequence we were able to open and keep clear the highways. However, downed utility lines and fallen trees hampered our snow removal operations until such time as the utility companies came in with supplementary forces from out-of-state, and joined our crews in clearing roadways of these obstructions. While we claim that the storm of February was the most troublesome to our own forces, the severest to the community as a whole was the March storm, due to its destruction, which caused many communities to be without heat, light and telephone for extended periods.

Warnings of Storms

Warnings of approaching storms are received from the Weather Bureau via teletype in the headquarters office. (This method of receiving advance information as to the approaching storms has been so satisfactory that it is planned that in future years, a teletype will be installed in each of the District offices.) All Districts are immediately alerted. At the District level, preparatory plans are made for the best method of handling the type of storm which has been forecast. Crews and equipment are placed on a stand-by basis so as to prevent the storm from getting a head start. Our limited experience leads us to believe that this is a most important procedure—"move ahead of the storm with all available equipment and material". Following this practice, we have found that it is possible to maintain ice free surfaces during and after storms. Prior to installing this program, our forces had been required to spend long periods after the storm in freeing road surfaces of ice by the use of graders, plows and even hand labor methods.

● **ONE OF four steel storage bins for salt. Use of such bins may save as much as $11.30 per ton handling cost.**

As the storm progresses, the Districts report their weather and road conditions three times daily to the headquarters office where maps are kept current. Releases of this information to the press, radio and public keep the motorists informed as to the changing conditions of both the storm and road surfaces.

Radio for receiving commercial broadcasts has proven to be helpful in assuring that the information regarding road conditions is kept current. This is most important to the public and saves many telephone calls on already overcrowded lines. The press, in many instances, receives information from this Department in the morning. Yet the release is not in the hands of the public until the afternoon edition. This has proven very misleading. Consequently we feel the press should keep to a minimum, their description of road conditions. It can be readily seen that, with the rapidly changing conditions, it is impossible for them to present their information so that it is accurate at the time of reading.

The most serious problem which we encountered was the lack of our own radio communications. Although we had the wholehearted support of our weighing crews and the State Police on their already over-loaded bands, during the most critical periods of emergencies we were unable to contact and control our equipment. We feel that if radio on our band had been available, our problems would have been less difficult and we could have better served the public at a lower expenditure. Our own radio network is a must for next year.

Another major problem was the unnecessary tie-ups due to stalled vehicles not properly equipped to travel during sleet and snow storms. Traffic snarls resulted which, in some instances, extended for many miles. Naturally our normal operations were disrupted. In addition those motorists, who were properly prepared to travel, were caused unnecessary delays and inconveniences. An appeal to the State Police has established the policy which now requires these unequipped vehicles to park on the side of the road until they can proceed under their own power.

An amusing problem of the salt program, which we ran into, was convincing our older experienced personnel that we were helping traffic by using salt rather than the usual, dark in color, treated cinder abrasives. The police and the public were also in this category of non-believers but after seeing the results which we were fortunate enough to secure at the outset, many of these "Doubting Thomases" have become enthusiastic supporters of the salt program.

(*Continued on page* 182)

GETTING READY for WINTER WEATHER

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Chelan County Engineer,
Wenatchee, Washington

ANY HIGHWAY administrator charged with the responsibility of keeping public roads free from snow and safe for the traveling public during the winter months would be forever grateful to the person who could predict accurately the time and intensity of anticipated snowstorms. Or better yet, one who could tell you well in advance whether to expect a mild or severe winter.

The United States Weather Bureau performs a priceless service in forecasting storms and blizzards, and without them snow fighting units would be dependent upon grandpa's rheumatism to tell them when to expect trouble. But, until the time that long-range weather forecasting becomes a precise science, highway administrators must prepare for the worst and hope for the best in winter weather. For, regardless of whether the winter eventually turns out to be mild with little snow and many days of warm sunshine, plow frames must be mounted, sandpiles and sandhouses filled, snow removal equipment winterized, and every preparation made to clean snow quickly from the highways when it falls. If you are ready for winter when it arrives, yours is a fine efficient organization in the eyes of the public, but if you try to outguess the weatherman and delay preparations until winter actually comes, your operation is inefficient, and of course you should have known a month ago that it was going to snow today.

The winter of 1955-1956 was one of the most severe in the history of Chelan County. Snow started falling November 2 and stayed on the ground until the middle of the following May in the higher elevations. Charges against snow-removal operations were posted for seven calendar months of that winter. Every piece of snow fighting equipment that the County owned was in operation twenty-four hours a day, and other equipment was rented and pressed into service. By the middle of February some progress was apparent. Until then it had been a matter of keeping even with the snowfalls. Snow removal costs were the highest in history for our neighboring counties, ourselves, and the State Highway Department. It was fortunate that all agencies had sniffed snow before it actually came and were prepared for it. There was very little delay in starting removal operations. Although that winter was a real tough one, it at least quieted the old-timers who were forever talking about the rugged winter of 1915.

In contrast, the winter of 1956-1957 was mild, with very little snow and lots of sunshine with warm temperatures. This last winter of 1957-1958 was even more mild, and actually set new records for low precipitation and high temperatures. This was all happening in the Pacific Northwest, normally a heavy

● **ONE OF Chelan County's six motor graders, with side wing attachment, is shown widening the shoulders of a road after the initial plowing has opened it to traffic.**

snow area, while the midwest and Atlantic coast states were experiencing one of their worst winters on record. Even the Southern and Gulf states had snow for the first time in a half century. How we all would have appreciated that pinpointing, long-range forecast.

In retrospect it is easy to see where money could have been saved in our preparations for this winter. Snow removal is a frustrating maintenance operation at best, and when money is spent in preparation for snow that never comes the frustration is doubled.

County Problems

Chelan County is located in the geographical center of the State of Washington. In area, it is the third largest county in the state, comprising some 2931 square miles. Its elevations range from 620 feet above mean sea level at the Columbia River on its eastern border to 8500 feet and higher at the summit of the Cascade Mountains on its western border. Most of the economy, and consequently the bulk of its road network, is below the 2500 foot elevation, and is concentrated along the rivers that flow from the mountains to the Columbia River. With the exception of two primary state highways that cross through mountain passes to the coastal areas, the roads in the higher elevations are built and maintained by the United States Forest Service and require no winter maintenance. The topography is extremely rugged with many high ridges cut up by deep and narrow canyons that make road building and road maintenance expensive.

The economy of the county, which is devoted principally to agriculture, logging and lumbering, cattle and dairy farming, and aluminum reduction is served by a system of roads administered by the State of Washington Department of Highways and the Chelan County Highway Department. State responsibility extends over 127.17 miles of Primary State Highways and 40.20 miles of Secondary State Highways, while Chelan County is responsible for the administration of 581.11 miles of county roads. This network serves the 43,000 residents of the county and the unnumbered thousands of tourists that visit this area each year to enjoy its natural beauty and resources.

The principal agricultural product is the world-famous Wenatchee apple, which is noted for its quality and premium grade. Because it is such an important commodity it is necessary that all roads serving the orchard areas be dust-free to prevent damage to the fruit by insects that thrive on dusty foliage. Consequently nearly 60 percent of the county road mileage is either bituminous or concrete surfaced, the highest percentage of any county in the State.

The wide range of elevations and the rough topography affect weather and storm conditions, which will vary widely in different areas of the county from day to day. The prevailing winds are from the northwest, coming south from the Gulf of Alaska, and as the storms drive eastward over the Cascade range they deposit their snow load on the eastern slopes. Total snowfall will vary from 250 inches on the mountain passes to 36 inches at the Columbia River. Snowfalls of 18 inches are not unusual at the lower levels, and may run as high as 48 inches at one time in the higher elevations. A normal snowstorm (if there is such a thing) will deposit 6 to 10 inches at one time on the roads. A few areas of the county are subject to drifting conditions if the snow is light and dry and the wind is from the right direction. However drifting is not as serious in our county as it is in the Columbia Basin counties to the east of us. We do not consider it to be one of our major winter maintenance problems.

Winter driving is hazardous under any condition, but, contrary to the view of most motorists, it is not so much the heavy snowfalls that create this condition as it is the real light fine snow that succeeds in covering the roads and highways with an icy film and turns them all into skating rinks. Heavy snows can be removed with plows, and normally there is always sufficient "bottom" to provide traction for snow tires and chains. With prudent driving and proper winter preparation the average driver should experience no great difficulty in getting about. The icy road presents an entirely different driving challenge that too many motorists are unprepared to cope with. The road condition is not apparent to the driver, and usually the first time he is aware of it is after he has put on his brakes and crashes into another vehicle or ends up in a ditch.

Icing conditions present a serious winter maintenance problem, for unless the sun or rising temperatures melt the ice the only remedy is to pour on the sand and provide as much traction as possible. Obviously stockpiles of sand are too small to sand all the roads, and sanding equipment cannot cover all the roads at the same time, and as a result there are bound to be unfortunate situations arise that can be prevented only by the vehicle operator.

County Operations

The County has operated under the "unit" or "one road district" system since 1923. Under it the three elected members of the Board of County Commissioners appoint a qualified licensed engineer to the position of County Engineer, who is then responsible for the maintenance and construction of all county roads. All equipment, personnel, and facilities of the road department are under his supervision and direction, and road district and commissioner district boundaries are non-existent as far as the operations of his department are concerned. All employees are responsible directly to the County Engineer. Experience has shown

● **TWO MOTOR graders in tandem on drifts about 4 ft. deep. First grader has a front-mounted plow elevated to break top of drift. Second grader windrows for rotary.**

this to be a very efficient type of operation, and is especially so during snow removal seasons. At the discretion of the Engineer, men and equipment may be dispatched to any area that has been particularly hard hit by winter storms.

A county that has a large area cannot operate its highway department effectively from one central location. Distances are too great to move men and equipment to and from the work site each day. Crews must be located at other headquarters convenient to the roads they are responsible for. They must be provided with proper equipment, tools, yard area and storage to do their job, and they must be supervised by a foreman who is familiar with his roads and capable of leading men.

Our central shop with its store room is located at Wenatchee, the county seat. It is staffed with a shop foreman, partsman, lubeman, blacksmith, two welders, and four mechanics. All major repairs to the equipment are made here, and all parts and supplies are handled from the storeroom. It is equipped with modern machine tools and equipment, and many original devices for our use have been designed and built here.

Maintenance crews are located in four other towns of the county outside of Wenatchee and the farthest station is 35 miles from the central shop. Each is under the direction of a foreman, who is responsible to the county maintenance supervisor, who in turn is responsible directly to the County Engineer. Crews vary in numbers from two to twelve, depending upon the miles of roads they are each responsible for. All have the same type of equipment of relatively the same age. Rules and regulations governing wages and operations are the same for all, and as nearly as geographically possible each crew has the same kind of working conditions.

Our snow removal fleet consists of 34 vehicles. This is made up of 23 trucks, 6 motor graders, 4 tractors and snow blades, and one SnoGo. With the exception of the SnoGo all of the equipment is used during the remainder of the year in regular construction and maintenance operations. The truck fleet is made up of Internationals, FWDs, and GMCs; the motor graders are Caterpillar, Adams, and Allis-Chalmers; tractors are Caterpillar and International, and the SnoGo is mounted on a Model SU FWD truck. The smaller trucks are equipped with ten-foot reversible blade plows, and the larger ones with the same type twelve feet in length. Both sizes are hydraulically controlled from the driver's seat. The plows, circles, frames, and lifting mechanisms were all designed and built in our own shop by our own crews, and we believe they are superior to manufactured plows for our type of operating conditions. The cost of building them has been less than the price of comparable commercially manufactured equipment. All trucks are also equipped with a "Chelan County Built" mechanical sander mounted on the rear of the dump bed.

Motor graders are equipped with reversible plows 12 feet in length, mounted ahead of the front wheels, and controlled by the scarifier mechanism. Three of our patrols are also equipped with side-mounted, hydraulically controlled wings designed to widen the roadway by shoving the snow away from the shoulder. These may be raised or lowered, and angled as the operator desires. A motor grader with these two attachments and the regular moldboard is able to move a tremendous amount of snow at one pass. The wing and plow were built in our shop from suggestions made by our employees.

The fleet of trucks is usually sufficient to remove snow up to depths of 10 inches. Deeper snows and widening operations require the services of the motor graders with their larger plows and wings and greater power. Slides and drifts must be moved by the SnoGo and dozers, operating individually or in combination as the situation warrants. Roads that have not been plowed regularly during the winter and are opened up in the spring also require heavier equipment. In one such instance, because the snow was so hard-packed and frozen, an International TD 9 tractor and dozer was put out ahead of the SnoGo to loosen the snow and push it down to the augers of the rotary. Without the dozer the SnoGo was unable to make any progress. Quite often drifts must be broken up in the same manner.

One particular one-mile section of road along the south shore of Lake Chelan is subject to slides composed of snow, rocks, trees, stumps and all the other variety of things that grow and exist on a steep mountainous hillside. No satisfactory substitute for a tractor and dozer has yet been found for clearing the road when these slides occur. Slow-burning blasting powder was tried on one particular slide, but it succeeded only in blowing a large hole in the snow and leaving the bulk of it to be removed by the dozer. These slides come down wherever there is a depression in the hillside above the road, and after one particularly bad series we counted 35 roadblockers in one mile. It took over a week for a dozer, motor grader, and two truck plows to reopen the road for traffic. Fortunately the snow can be pushed into the lake and does not require handling more than once.

● **END OF the line: Typical of the slides along the south shore of Lake Chelan. The 30 slides shown here were removed with dozer, motor grader and truck plows.**

Although there are 581 miles of road on the county system, 448 miles are kept open at all times during the winter months; of this, 310 miles are used by school buses and mail carriers. The remaining mileage is broken open in the spring when it is reasonably certain that the heavy snow season has ended. Each snow-removal unit is assigned specific roads to maintain, and when their

work is completed they may be sent to the assistance of other units. The average assignment per unit is 16.0 miles, varying from a maximum of 20.0 miles to a minimum of 12.2 miles. The equipment with the minimum mileage, however, must "deadhead" an average of 24 miles over State Highways before they can start their designated work. A minimum of four "passes" over the assigned mileage is required of each vehicle. Two of these are for removing the snow from the traveled part of the roadway, and the other two are for widening the shoulders. If sufficient equipment is available the plows are routed in tandem. When all plows are in operation after a general snowstorm they must travel nearly 1800 miles, plus their "dead-head" mileage to clear all the roads. If this were all in one stretch with no intersections and no dead-ends, it would be a relatively simple and quick operation. But snow removal is not simple; it's only exasperating. In this mileage we have 516 intersections; 228 cul de sacs where equipment must turn around; 35 school bus turn-arounds that must be widened; and 163 miles of dead-heading over other road systems. These obstacles slow down the work and run up the cost.

We consider it unnecessary to plow snow less than three inches in depth. But, here's where we need the crystal ball again—how do you tell how deep any snowfall is going to be until it's finished? As a matter of policy our crews are ready to go when three inches of snow is on the ground. School bus and mail routes are opened first and the remainder of the roads plowed in the order of their economic importance. Two passes can be made in a normal eight-hour work day, and the widening completed the following day. Our regular crews of some 39 men are usually sufficient to handle the job, but often during a series of severe storms we employ extra help and operate on a two-shift basis. A work day of twelve hours is the maximum for any employee. Equipment is serviced in the field by the foreman, who has gas and diesel fuel supplies in his pickup truck.

Obviously, the cost of snow removal depends upon the kind of winter weather and the amount of snowfall. Our costs for this last winter averaged $93 per mile of road plowed, while for the winter of 1955-1956 it was about $400 per mile. As the traveling public demands more and more winter service the cost per mile will increase correspondingly.

● **TRACTOR and dozer break up packed and frozen snow and feed it to rotary plow. The tractor is operating on top of a bank about 6 feet deep in a heavy snow area.**

Coordination of activities would be impossible without communication between field and headquarters, and between crews. One of the best ways to establish this communication is through the use of radiotelephone. This method has been used by the Chelan County Highway Department since 1950, and the benefits derived from it are immeasurable in dollars and cents. The convenience and efficiency of operation that result from the employment of this very useful tool more than offset the initial cost. Our system, which consists of one 60-watt base station with a remote control unit located at the shop and at the County Engineer's office; telephone and power lines; and 10 mobile units of 60-watts each cost originally about $12,000, or about the price of one truck outfitted for snow removal. We believe that by the use of radio we have been able to utilize the equipment we now own to a degree of efficiency that permits us to operate with two less trucks than would be necessary if we were without it. Equipment can be dispatched quickly to the point where it is needed. The operators feel a greater sense of security, for they know that in the event of a breakdown they can call the base station by telephone and radio-dispatched assistance will be on the way without delay. The taxpayer also has come to realize that his complaints to headquarters will be given prompt attention by a foreman who has received the necessary information via his mobile unit.

The mobile units are installed in the engineer's car, maintenance supervisor's station wagon, shop foreman's panel truck, two survey crew station wagons, one truck, and four foremen's pickup trucks. An extra unit is kept on hand for a spare. Each morning before the crews leave their respective bases for the day's work the maintenance supervisor contacts each foreman and receives reports on the proposed activities for the day. Equipment is shuttled around where needed and changes in the work schedule are discussed. Any directives from the County Engineer are issued, and by the time the foreman is ready to line out his crew he is familiar with activities all over the county. Any changes in plan or reports of conditions that need immediate attention can be sent out when required. The base station is on the air nine hours each day. When crews are working nights or overtime it is in service during that time.

We have found that there is no slack season in the value of radio. Our transmissions are actually more numerous during the construction season than during the winter. However, it is more valuable at that season to report road and weather conditions which are passed on to the traveling public. No time of the year is convenient to have the radio system out of service.

There is no cheap way to remove snow. It is a costly and frustrating maintenance operation that requires patience, perseverance and, most important of all, a good sense of humor. Many strange devices have been contrived by the mind of man to throw more snow farther and faster than his competitor. Some of them work, and some don't, but without any question of a doubt, the most efficient and effective snow removal equipment now in existence is a few hours of good warm sunshine.

TURNPIKES

are expected to be SNOW FREE

● **CLEARED roadway is threatened by a new strom moving in from the northwest. This article tells how the Turnpike operates.**

L. W. NEWCOMER,
Chief Engineer,
Kansas Turnpike Authority

MAINTENANCE forces along the 236-mile Kansas Turnpike breathed sighs of relief in March, 1958, as they parked their winter equipment in the Turnpike's maintenance yards and checked out machinery for spring and summer work.

Although only in their second winter of operation on Kansas' first modern toll expressway, and thus inexperienced in Turnpike operations, the maintenance men became veteran experts quickly during the 1957-58 winter season, battling 24 snows, several additional ice and sleet storms and almost continuous winter moisture. This is an unusual winter record in Kansas.

These storms varied from thin but tricky ice coatings, quickly dissipated by Turnpike traffic and the judicious spreading of mixed sand and salt, to a 36-hour blizzard with a 15-inch snowfall. This storm caused a 9-hour blockade on a short section of the Turnpike, the first and only time the 4-lane divided roadway had been blocked by a winter's storm in its two years of operation.

The late January blockade on a 12-mile section near the eastern terminus in Kansas City, Kansas, was due mainly to abandonment of snow-trapped vehicles, which prevented proper operation of snow removal equipment through the clogged area. When the stalled cars were moved, continucus patrol by heavy removal equipment kept the roadway open despite drifting induced by icy winds even after the fall ended.

On the theory that toll road traffic would expect first class winter maintenance on the Turnpike, maintenance superintendents, foremen and crews were selected as far as possible from experienced state and county highway workers. They were given instructions on problems peculiar to expressway operations.

The crews were organized into eight sections, each responsible for approximately 30 miles of maintenance roadway, with division headquarters at Wichita supervising four southern sections and another division office at Topeka handling the four northern sections. Each section has a maintenance office and storage yard with a foreman and three men—all machine operators —on regular daytime duty. Emergency crews varying from four to six men are available in each section for storm duty, permitting round-the-clock operations when necessary.

2-Way Radio

This crew is directed by the chief engineer from Wichita headquarters and the assistant chief engineer at the Topeka headquarters, with two maintenance engineers in charge of four sections each. The entire maintenance organization is closely knit by the Turnpike's own system of microwave and VHF radio channels, providing instant communications between mobile and fixed stations the length of the Turnpike.

The 2-way radio network, based on 2-channel microwave and 4-channel VHF with relay and repeater stations, has a central control in the communications office at headquarters. However, the 75 mobile and 28 fixed units also can communicate directly with each other in order to speed and coordinate efforts during storm emergencies.

There are 16 maintenance trucks equipped with the 2-way radio sets; two are assigned to each 30-mile section. In addition, both maintenance engineers, the assistant chief engineer and the chief engineer all

have mobile units in their cars, providing 20 mobile communication units operating directly on a maintenance radio channel. In addition, two microwave channels connect all fixed stations at section and division shops with headquarters for 2-way conversation.

The Turnpike network also operates police as well as maintenance channels with cross-channel operations possible. Under this system, Turnpike maintenance officials can be on top of the weather conditions almost anywhere along the roadway in a matter of minutes.

Troopers from the Turnpike unit of the state highway patrol use the police channel and patrol constantly on 24-hour shifts. Under most conditions, reports from these troopers to headquarters and then to top maintenance men put maintenance crews onto the Turnpike for snow and ice control or removal. Through this system, even short and spotted iced or snow-slicked sections of the roadway are brought to the attention of maintenance chiefs, and crews are alerted for stand-by duty or quick action.

For snow and ice removal, the Kansas Turnpike has purchased some of the most modern equipment, and owns sufficient machinery to handle most maintenance jobs. However, it has emergency rental equipment available in each division for emergency needs.

Snow Plows

The equipment includes 24 1-way snow plows, the basic snow-moving equipment, since on ordinary Kansas snows a 1-way blade attached to the front of a fast-moving truck can toss snow from a 3 or 4-inch fall far off the roadway with little loss of time. The 30-mile patrol section thus can be cleared completely in about two hours. Twelve of the 1-ways are located at strategic points in each division.

For lighter snows and ice removal, maintenance has 32 "pony" blades, 16 to each division. These are small pull-type graders attached to trucks and used to kick off slush and light snows on a diagonal shear. Use of the "ponies" provides even faster clearance than is possible with the 1-way plows. For heavier work, there are 8 reversible plows, four in each division, and six "V" type plows, for use on patrol graders; three in each division. For heavy snowfalls, the "V" plows pushed by motor patrols are used down the center of the roadway with 1-ways operating on each side to toss the snow into the 20-foot median strip or off the outside shoulder onto the unused portion of the 300-foot right-of-way.

For ice or after the removal of most snow, sanders are put to work to provide traction for traffic. Trucks are equipped with rear-mounted mechanical sand spreaders to distribute a mixture of 8 percent rock salt with sand and cover most of the 24-foot roadway at a single pass. Then the "ponies" are brought into play to move the resulting slush, and the roadway usually is then quickly back in service. When necessary one lane is opened in each direction to move traffic and then crews turn attention to the passing lanes.

During the 1957-58 winter, maintenance crews spread about 5,000 tons of salt and sand, a much heavier consumption than is usual during Kansas winters.

Ice and snow removal on the Turnpike cost slightly more than $21,000 above normal in January for extra labor, material and extra machine rentals; approximately the same in February; and above $10,000 extra in March, since the abnormal storm period continued well past mid-March. Budgeted for snow and ice removal cost is $50,000 annually, which in normal years would be more than sufficient.

Kansas is plagued with a weather situation that is unique. For days at a time in the winter, temperatures hang near the 32-degree mark, sometimes just above and at other times just below freezing, with a light rain falling. This condition can turn a wet pavement into an icy surface in a matter of minutes, resulting in a rash of minor skids and accidents. This is especially true on bridges and beneath over-passes. These danger spots are given particular attention by troopers and on-job maintenance men. At the first sign of danger, spreaders with their salt-sand mixtures are put to work on the bridges, their approaches and on hills.

The Turnpike beneath overpasses also is tricky in freezing weather. Even on the sunny days after storms

● SMALL loader starts the job of opening up the West Lawrence toll plaza immediately after the blizzard has ended.

● TRAPPED in drifts from 15-in. snowfall, 7 abandoned vehicles in west lane block operation of removal equipment.

or freezes, frost in the roadway surfacing keeps a strip in the structure's shadow iced, thus providing a trap for unwary drivers. Patroling troopers also pay special attention to these danger spots.

Weather Information

To keep track of weather conditions, the Turnpike headquarters, by radio, collects data four times daily from toll collectors, on conditions at each interchange. The samples are taken at 6 and 10 a.m. and at 5 and 9 p.m., giving temperatures, cloud conditions and moisture. Each interchange hears the reports from all others. In addition, 24-hour reports from the federal weather bureau are received by teletype at headquarters. Threatening conditions either locally on the Turnpike or moving in from other areas thus are received regularly and the reports are used to alert key maintenance personnel in each section. Mobile emergency equipment is kept ready at division headquarters to reinforce regular equipment at any point.

The importance of this weather information network, plus the advantage of instantaneous communications between maintenance men in all areas cannot be over-emphasized in surveying the success of snow and ice control and removal on the Kansas Turnpike.

Icing conditions, as opposed to snow fall, seem to run in cycles in Kansas. During the 1956-57 winter, there was comparatively little ice and the same condition held for several years previous. Last winter, there was a heavy increase in icing of roadways, accompanied by its increased maintenance costs and wear on crews.

During one particular icing period, maintenance forces sanded most of the 236-mile highway four times in 48 hours. Generally, however, the Kansas weather pattern and the Turnpike alinement are such that only one-half the Turnpike is stormbound at one time. Sometimes this is the middle half, through the Kansas Flint Hills; at other times the northeast gets heavy snows while again the southern half usually is more plagued with ice. And ice costs more per drop of moisture to move from a roadway than any other form of moisture.

When the battle of winter is over, the maintenance equipment is returned to section yards and sheds when only minor repairs or cleanup is required. And this task is assigned to slack periods or rainy days during the summer and fall months when outdoor maintenance is impractical. Equipment needing major repairs is handled in most cases at fully-equipped machine shops at both Wichita and Topeka division headquarters. Equipment sheds are available to keep most of the machinery out of the weather when not in use.

Under the chief engineer with Wichita the headquarters, the maintenance set-up also includes Ross Keeling, assistant chief engineer, with offices at Topeka. Everett Wichers is superintendent of machinery for both divisions. Maintenance engineers include Harvey Hofstetter at Wichita and Tom Crawford at Topeka.

The winter maintenance personnel fluctuates with need—being 88 in November, dropping to 80 last December; climbing to 111 during the storms of last January; 101 for February's stormy period; and then dropping below 100 again in March as the storms abated ahead of spring.

By constant and concentrated efforts during winter storms, the toll road was kept open when most competing highways were closed or dangerous and so drew much of the traffic that was forced to be on storm-bound highways. Knowledge that the Turnpike roadway was usable, even if hazardous at times, also was credited with inducing traffic to move on the Turnpike and so contributed to the 18 to 29 percent traffic volume increases marked up last winter over the same months of the previous winter.

Travelers quickly learned to look to the Turnpike when storms made regular highways dangerous. They knew that despite slippery driving at times, they were safer on quickly cleared, divided Turnpike lanes, surfaced 38 feet in each direction, than they were on narrower 2-way regular highways.

● **ONE-WAY plow throws snow and slush from Turnpike and shoulder after center is cleared. "Pony" blades complete job.**

● **SNOW PLOWS quickly open one lane to traffic and keep it open during storm; then work on passing lane and shoulder.**

WATER SUPPLY EXPANSION PROGRAM WILL PROVIDE FOR DRY SPELLS

GEORGE H. SPARKS

Superintendent, Public Utilities Department, East Point, Georgia

DURING the long dry period in 1954, the source of water supply for East Point, Ga., Sweetwater Creek, was so low that people could walk across it without getting wet feet by dodging the few water holes in the sandy bottom. The flow was so small that we held a reserve for fire protection and severely restricted use of water for sprinkling lawns and washing automobiles. This shortage taught us the need for a more adequate supply and we started a program of progressive improvements which will provide capacity for our needs for a considerable time.

East Point, said to be Georgia's eighth largest city, is more highly industrialized than many others in its class. Its water system also supplies College Park, which adjoins us on the south. There are only a few industrial sites left in the area; so most of the future increase in water consumption will be for residences and smaller businesses.

The original water system of East Point, started in 1909, consisted of several deep wells with an air-lift system of raising the water to a surface reservoir, and pumps to force it into a standpipe. Other deep wells were drilled from time to time in several sections of the city and the water pumped into the system after aeration and sometimes iron removal. By 1941 the city had outgrown this method of obtaining water. The present system, consisting of a pumping station located on Sweetwater Creek, a ten-mile long, 20-inch diameter, raw water supply line, a two-million gallon a day filtration plant, and a one-half million gallon overhead storage reservoir, was started in 1941. This system was placed in service, after wartime delays, in 1944. It served about 15,000 people in East Point and College Park. The pumping station is located approximately one mile on the other side of the larger Chattahoochee River. The Sweetwater Creek location was selected for the pumping station because daily minimum flow of record from 1937 to 1941 was ten times our maximum daily use and the Chattahoochee River water quality was not very satisfactory.

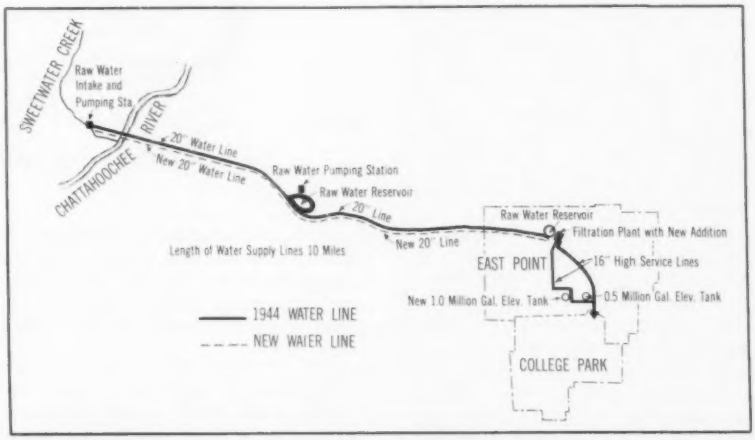
The present expansion program was undertaken in 1954. It includes a 750-million gallon raw water reservoir above the intake located on Sweetwater Creek. There will be an additional 20-inch raw water supply line; four million more gallons normal filtration capacity; and two 4 mgd high service pumps at the water treatment plant. A new one-million gallon elevated storage reservoir will be constructed on Pearl Street and a new 16-inch high service line will connect the treatment plant with both the new and existing tanks.

The cost of this work will be approximately $1,500,000. When the expansion program is complete with water storage above the pumping intake, the added pipe line, the extensions to the filtration plant and the additions to the distribution system, East Point will have a water system with a normal capacity of eight million gallons. It should be able, with a reasonable overload during emergencies, to supply the needs of East Point and College Park and permit considerable future growth. When the proposed 750-million gallon raw water reservoir in Douglas County is constructed, the system should be able to withstand even such a dry season as 1954. Assuming a minimum flow of 2,000,000 gallons daily from Sweetwater Creek, the reservoir would supply enough water for 90 days.

As a result of bids for material only, the city purchased approximately 50,000 feet of 20-inch diameter, 0.25-inch wall thickness, Armco steel water pipe, lined, coated and wrapped in accordance with AWWA Specification C-202. This pipe for the new raw-water line paralleled the existing 20-inch pipe about 20 feet away. The ends of the pipe were prepared for Dresser couplings, Style 38, with 5/16 by 7-inch middle ring. The pipe was field tested to 250 psi.

At one location where the old line crossed on a trestle above a railroad, both old and new pipe now pass under the tracks in an inverted siphon. Armco liner plates were used for tunneling under the tracks to provide a casing for water pipe. The pipe laying project was started on January 21, 1957. The thirty-day trial initial operation period was started last summer.

Contractor on the pipe laying work was Southeastern Contracting Company of Birmingham, Alabama, W. P. Cox, Jr., proprietor. Designing and consulting engineers for the city are Wiedeman and Singleton, Atlanta, Georgia.



● **EXPANDED water supply for East Point included construction of a new 20-inch supply line from Sweetwater Creek intake to the city and filtration plant addition.**

HORIZONTAL COLLECTORS *will Improve* UNDERGROUND WATER YIELD

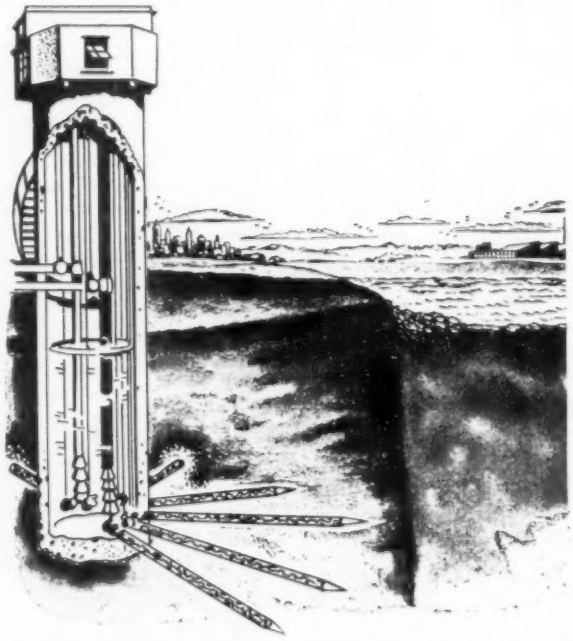
JOHN R. WALLACE, JR.,
Partner, R. W. Beck and Associates, Utility Analysts and Engineers, Seattle, Washington and Columbus, Nebraska

THE AVAILABILITY of underground sources depends upon the geology of the ground which must contain aquifers of sufficient thickness to supply the demand and must have percolation characteristics which will allow precipitation to recharge the aquifer. If the aquifer or aquifers are of sufficient depth and the precipitation and percolation rates are adequate, the vertical type well can normally produce the quantities of water desired. Capital requirements are relatively small because underground sources normally do not require biological or turbidity treatment.

A river or lake provides a natural reservoir of water, but quantity and quality may vary with the seasons. If a hydraulic connection between such a body of surface water and the adjacent ground water table exists, then a collector located so as to draw water from the lake or stream during the low stage and, at the same time, draw the ground water flowing toward the lake, will provide a more sustained yield than a deep well which is tapping the aquifer only. The extent to which this "induced infiltration" can be developed is, of course, dependent entirely upon the permeability of the aquifer connecting the body of water with the collector.

Temperature, contamination and turbidity of a river or lake vary with the seasons. Induced infiltration from the river or lake through the aquifer provides a natural means for the removal of turbidity and contamination and tends to cool the water during the summer months. The mixing of the infiltered water with ground water having a uniform temperature, turbidity and contamination levels, tends to produce an overall product which has considerable uniformity in quality.

Turbidity and contamination of the induced water may be completely removed from the water by its passage through the aquifer, and the chemical quality will be essentially that of the body of water being tapped. Since the source of supply of the body of water is surface runoff, the chemical properties of this water may be superior to the chemical properties of ground water. Iron is a troublesome mineral that occurs frequently in water supplies of the Pacific Northwest. The effect of the movement of river water tends to precipitate the iron and the precipitate is in turn removed from the water by the aquifer. If the ground water contains objectionable levels of iron or other minerals, these levels may be reduced by increasing the portion of the induced infiltration and decreasing that of the ground water.



● **SCHEMATIC sketch shows construction of horizontal wells.**

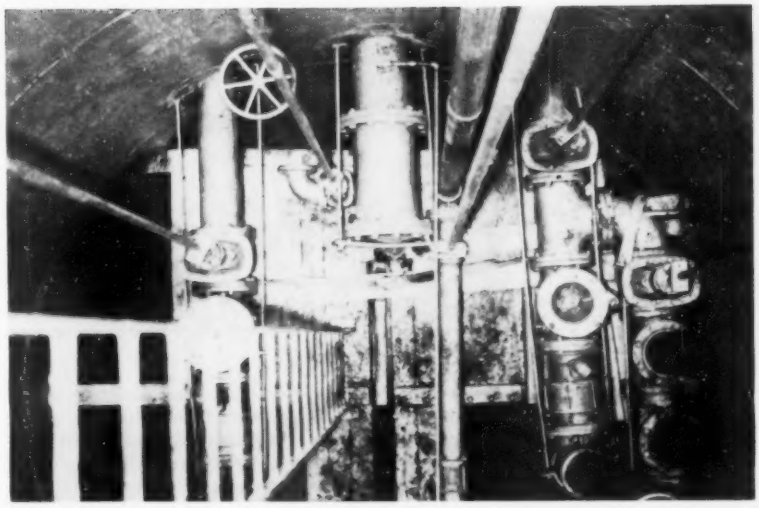
The Ranney well is essentially a vertical collector of large diameter from which horizontal collectors radiate as the spokes of a wheel from a hub. The vertical collector is a concrete shaft of 13 feet inside dimension which is sunk to the desired depth in the aquifer. The bottom of the shaft is sealed by means of a concrete plug. The horizontal collectors radiate from the bottom of the shaft and are jacked radially

This article is based on a paper presented at the 1957 Annual Conference of the Pacific Northwest Section, American Water Works Association.

from the vertical collector through previously installed pipe sleeves. A specially designed, bullet-shaped, slotted driving head is welded to the entering end of the first section of each horizontal collector. A 3-inch water line is connected to the digging head. As the pipe is jacked horizontally into the ground, sand and gravel surrounding the head are washed into the slots of the head and through the 3-inch line into the vertical collector. This method removes from 3 to 7 cubic feet of fine sand and gravel for every foot of pipe projected. Pressures required for the projection of the pipe are heavy in the first few feet of penetration but diminish as pushing proceeds. Pipe has been projected for distances as great as 370 feet. The final effect is that of a full length screen acting as a subdrain in a filter surrounded by a hydraulic circle of coarse gravels several feet in diameter. As each horizontal collector is completed, a valve is attached to that collector on the inside of the vertical collector. This valve serves two purposes: the first to prevent flooding of the vertical collector during construction; and the second, to allow selection of horizontal collectors during normal pumping operations to facilitate the choice of water. Installed in the collector, of course, are pumps of various sizes as required and the provision of a pump house at the ground level.

The installation of an infiltration gallery by the normal cut and fill methods is quite expensive, particularly if it is desirable to extend such gallery under the stream bed. Since the vertical collector for the Ranney well has been sunk to depths up to 220 feet, it is apparent that the choice and use of existing aquifers at depths beyond the economical limits by normal cut and fill methods can be readily made. Furthermore, horizontal collectors may be driven under the stream bed if so desired. The location and length of the horizontal collectors, both vertically and horizontally, are dependent upon the thickness and location of the aquifer, the hydraulic connection between the body of water and the well site, the quantity and quality of water available from the river or lake, and the quantity and quality of water available from the underground sources.

A detailed study of the geological features of the area in which a collector is to be installed is the first step to determine if a Ranney well is feasible. Since deposits are heterogenous and hydraulic conditions may vary in wide limits within short distances horizontally and vertically, extensive geological surveys are necessary.



● **LOOKING down the shaft or caisson. Piping and working platforms are shown. Capped pipe in center foreground is for use in case of future pumping expansion.**

The studies required to determine the feasibility of a potential Ranney well site consist of sinking a series of 12-inch diameter observation wells at some distance from the body of water and a series of 6-inch diameter wells around the 12-inch wells. Water is then pumped from the 12-inch wells and water level readings are taken on float recorders installed in the 6-inch wells. The data so obtained are used to determine the capacity and permeability of the aquifer lying between the body of water and the well site.

Geological investigations along the banks of the body of water involved may show a number of sites in which such a well may be installed. Analysis of the water itself, however, may indicate the need for sacrificing quantity for quality and such water analysis is an important factor in determining the location of the site.

As Consulting Engineers for Public Utility District No. 1 of Skagit County, Washington, we recommended the installation of the first Ranney well on the Pacific Coast. The District has in operation in their system many different water supply sources. The mountain sources consist of a 450-mg reservoir supplied by a watershed which requires extensive reforestation. This reservoir is connected to the system by a transmission line which is too small to meet present day needs. Furthermore, the transmission line had a weak link (now corrected) consisting of an under-river crossing, and the transmission line passes through three towns of which the largest is at the end of the line. The system also has a vertical well from which water is added to the mountain supply to improve both its quantity and quality. In addition, a filtration plant is provided drawing water from the Skagit River to supplement the needs of the largest town at the end of the transmission line. The filtration plant is located on land which made expansion of these facilities costly.

These problems necessitated study of the needs of the District and that study indicated that the installation of a new transmission line from the mountain reservoir was not then economically feasible. In the interim, the quantity of water available through the existing transmission line from the mountain supply, the vertical well and the filtration plant was not adequate to meet the peak demands of the area. Geological exploration indicated that the spotty nature of the aquifer and the iron content of the underground water in the areas precluded the installation of additional vertical wells because of the number required and cost of providing iron-removal treatment. The studies indicated that the quantity required for the interim period was in the neighborhood of 5 mgd and that the Ranney well could provide such quantities and reduce the iron content at less cost. Furthermore, because of the peculiar short time duration and extreme height of peak requirements, the Ranney well will be utilized to meet these peak demands, thus creating economies in the future transmission line by reduction in pipe line size.

MAINTENANCE and OPERATION of GOVERNMENT BUILDINGS

CHARLES A. BETTS,
Director of Information,
General Services Administration,
Washington, D. C.

ONE OF the General Services Administration's many diversified tasks is maintaining and operating buildings the Government owns and leases. Varying as they do in size, age, type of occupancy and geographic location, these buildings present almost every conceivable type of operational problem.

The cleaning of this space (over 100 million net square feet of it in all) probably accounts for the largest single expense item in GSA's annual operating budget, but it is only part of the total maintenance job they do. Other responsibilities include heating; lighting; air conditioning; ventilation; plumbing; painting; structural maintenance; operation and maintenance of elevators and escalators; care of the grounds; protecting (guarding) the buildings; their contents, and grounds; and the furnishing of communications service (telephone and teletype). Then there's also the repair, renovation and improvement of buildings as they become outdated, and the repair and replacement of worn-out and outmoded operating equipment.

Obviously, in order to handle a job of such proportions, every part of the cleaning operation has to be carefully planned and systematized. GSA knows this and has gone all-out to "organize for service."

At present they have in effect standards for performance and production for each of the 26 jobs that go to make up the total cleaning operation. They have also developed, but in lesser detail, standards for certain other of the building operating functions, such as heating, air conditioning, electrical work, plumbing, painting, carpentry, etc. The development of these standards has taken place over a good many years. They are a composite of experimentations on the job, observations of the capacity and production of the average employee, and a careful study of all the standards developed by private building operators that could be obtained.

GSA considers five elements vital to carrying out successfully a large maintenance operation. Listed in their logical sequence these five elements are: 1) Determining performance and production standards; 2) assigning work in accordance with the production standards; 3) training personnel in standard performance methods; 4) using the best and most suitable materials and equipment for each of the various cleaning jobs; and 5) adequate supervision.

Each of these elements is important in itself, and the omission or breakdown of any one of them will lower the over-all quality of performance and the total productiveness of the work force.

The Personal Touch

The total maintenance job, so far as it relates merely to the mechanical tasks of keeping the buildings clean and in good operating repair, is of course completely impersonal. But when we consider the reason for performing these tasks—the tenants—the job takes on a more personal aspect. They must have clean, well-cared for space in which to carry on the affairs of government. GSA must not only see that the maintenance job is done, but has to get it done in such a way and at such a time that there is no interference to the occupants' work. Naturally, as the size of such an operation grows it is necessary to decentralize authority progressively so that responsibility and authority are kept as close to the day-to-day operations as possible. When this decentralization of authority does not keep pace with the growth of operations, nothing can keep operations from slowing down. The paper work involved in remote-control handling is one impediment, and the mere fact of distance is another. It is a psychological fact that authority and management tend to pull together better when they are near enough to have a good understanding of each other's problems.

With this in mind, GSA's five service units were surveyed recently by a commercial management consultant firm with a view to reorganizing for greater efficiency. One of the organizational changes that came about as a result of the survey of its Public Buildings Service (the Service that, among other things, is responsible for maintaining and repairing the buildings) was the establishment of Area Offices in August 1956. Each Area Office is under the direction of an Area Manager, who, in turn, answers to the Regional Office. (GSA has ten Regions.)

The Area Manager is close to the operations in his assigned area, which in most cases covers an entire state, and in others covers more than one. He has virtually complete authority to perform the full list of jobs that must be done in connection with operating, maintaining and repairing the buildings in his area. To be more specific, he has responsibility for operating and performing urgently needed repairs to all the buildings in his area which are under GSA jurisdiction, and for assigning space to the Government's agencies. He is also responsible for performing the urgently needed repairs to Government-owned Post Offices operated by the Post Office Department, hospitals operated by the Public Health Service, U. S. Mints, Border Stations, and Immigration Stations. Operating the GSA communications system in his area (the system includes a complete nationwide teletype network), and

GENERAL SERVICES ADMINISTRATION - PUBLIC BUILDINGS SERVICE

BUILDING CLEANING SURVEY

(For use in estimating the cleaning for proposed building operations and analyzing the cleaning of buildings already in operation.)

OCCUPYING AGENCIES

OFFICE HOURS

REGION

AREA OR DISTRICT

GROUP

BUILDING

ADDRESS

JOB	QUANTITY (By actual measure or count)	PRODUCTION RATE (Work per man-day)	MAN-DAYS PER JOB PERFORMANCE (QUANTITY / PRODUCTION RATE)	FREQUENCY (In work days)	MAN-DAYS OF LABOR REQUIRED					
					DAY SHIFT			NIGHT SHIFT		
					WBC-1	WBC-2	WBC-	WBC-1	WBC-2	WBC-
BUFFING	SQ. FT.									
CORRIDOR AND LOBBY POLICING	SQ. FT. - MAIN SECONDARY									
ELEVATOR CLEANING	PASSENGER FREIGHT									
ENTRANCE CLEANING (OUTSIDE)	MAIN (NO.) SECONDARY (NO.)									
GARAGE, DRIVEWAY CLEANING	SQ. FT.									
HIGH CLEANING	SQ. FT. FLOOR AREA SERVICED									
INSECT AND RODENT CONTROL	SQ. FT. FLOOR AREA SERVICED									
JARDINIERE CLEANING	JARDINIERES									
LAWN MAINTENANCE	SQ. FT.									
LOBBY CLEANING	MAIN (NO.) SECONDARY (NO.)									
MOPPING	SQ. FT.									
PAPER BALING	BALES (NO.)									
PAPER AND TRASH COLLECTION	SQ. FT. FLOOR AREA SERVICED									
ROOM CLEANING (OFFICE)	SQ. FT. (NOT INCLUDING CORRIDOR)									
ROOM CLEANING (FILE)	SQ. FT. (NOT INCLUDING CORRIDOR)									
ROOM CLEANING (STORAGE)	SQ. FT. (NOT INCLUDING CORRIDOR)									
RUG VACUUMING	RUGS (NO.)									
SCRUBBING (MACHINE)	SQ. FT.									
SIDEWALKS, PARKING AREA	SQ. FT.									
STAIR CLEANING	FLIGHTS									
TOILET CLEANING AND SERVICING	ROOMS FIXTURES									
UTILITY	GROSS SQ. FT. BUILDING AREA									
VENETIAN BLIND WASHING	BLINDS (NO.) SQ. FT. PER BLIND									
WAXING	SQ. FT.									
WINDOW WASHING	TYPE NO. SIZE									
SPECIAL JOBS - REMARKS										

☐ GOVERNMENT-OWNED	☐ LEASED	NO. OF OCCUPANTS	TOTAL JOBS						
GROSS AREA	NET AREA	NO. OF FLOORS	ALLOWANCES FOR LEAVE %						
PERCENT OF AIR CONDITIONING	CENTRAL VACUUM SYSTEM ☐ YES ☐ NO		TOTAL LABORER POSITIONS						
PERCENT			SUPERINTENDENT (Signature)			DATE			
OFFICE	WAREHOUSE	CLINICAL	OTHER						

● **BUILDING CLEANING costs are reported in this GSA form. Reverse side provides for analysis of data by Regional Office.**

the joint-use telephone switchboards GSA provides and supervises for agency use, are his responsibility, too.

The Area Manager has authority to make local purchases and enter into contracts. He has at his disposal the services of the Building Managers and staffs of the GSA-operated buildings in his area. Although he is a Public Buildings Service employee under their Office of Buildings Management, he also acts as liaison for the occupant agencies and the public with GSA's four other Services—the Federal Supply Service, National Archives and Records Service, Transportation and Public Utilities Service, and Defense Materials Service. By doing so he can often give the customer agency prompter service than it could get through corresponding with the Regional Office.

Under the Area Managers are offices of Buildings Managers, Building Managers, and Building Superintendents. The distinction between these three types of offices is this: A Buildings Manager is responsible for several buildings in one city or in a limited geographical area. A Building Manager is responsible for only one large building. A Building Superintendent is responsible for one smaller building. Each manager and superintendent has sufficient supervisory and custodial employees under his direction to furnish an adequate level of service in his building or buildings. His organizational unit is designed to be self-sufficient. A Buildings Manager has an advantage over the others. When the workload in one building is unusually heavy, or when there is illness or someone resigns, he can detail employees from one building to another to even the load.

In recent years GSA has had to stretch the operating dollar to maintain desirable service levels. Decentralizing authority down to the operating level and holding to the five rules they prescribe (development and use of production standards, assignment of jobs in conformity with them, training personnel, and adequate supervision) have helped them keep maintenance conditions from getting out of hand. Thanks to careful planning along these lines they have been able to keep the character of service on the highest plane possible with limited funds.

GSA finds that organizing for service pays off in quality and quantity of work performed, and in greater job satisfaction for all.

EXCERPTS FROM GSA CLEANING STANDARDS

JOB DESCRIPTION	QUALIFYING FACTORS	PRODUCTION RATE PER 8-HOUR MAN DAY	NORMAL FREQUENCY IN WORK DAYS
ROOM CLEANING Includes emptying wastebaskets and ash trays, sweeping or vacuum cleaning offices, vacuum cleaning rugs, sweeping adjacent corridors, dusting all parts of rooms and corridor spaces that can be reached while standing on the floor, dampwiping glass and other specified surfaces, and, when they occur in an assigned work area, cleaning wash basins, private toilets, phone booths and drinking fountains, taking proper care of the room cleaning equipment, and performing such other jobs as are assigned by the supervisors. (Cleaning Handbook, Section 2.)	Office Space	14,000 net sq. ft. (plus adjoining corridor area)	Daily
	File Space	Up to 50,000 net sq. ft. floor space	Daily
	Storage Space	Up to 100,000 net sq. ft. floor space	Depends on type of storage
RUG CLEANING (Vacuum) Rugs are normally vacuum cleaned after desks and other articles in the room have been dusted, so that any materials such as paper clips, shavings, etc., that may have fallen on the rug during the dusting operation will be picked up. Proper care and maintenance of equipment. (Cleaning Handbook, Section 3.)	Where presence of large number of rugs makes specific job assignments appropriate	80—12'x15'	Daily
SCRUBBING Consists of the daily and/or periodic maintenance of marble, terrazzo, and other hard floor surfaces by means of mechanical scrubbing equipment of the type required. Includes readying the equipment and preparing the floor cleaning solution; preparation of the area to be scrubbed; scrubbing the floor area; care, maintenance and proper storage of equipment and materials used. (Cleaning Handbook, Section 5.)	Gasoline-powered scrubber-vacuum machine	50,000 sq. ft.	Main floor corridors daily
	Electric floor polishing machine 15" rotary	20,000 sq. ft.	Secondary floor corridors every 5 days
	Electric-powered scrubber-vacuum machine	25,000 sq. ft.	Other space as required

ALUMINUM USAGE IN BRIDGES

The Greater New Orleans Bridge, longest cantilever highway span in the world, with its approaches is 2.3 miles long. The span and approaches contain nearly 600,000 pounds of aluminum. Applications on the New Orleans bridge include grating, railings, lighting standards and inspection walks. Highlights of aluminum use on the new bridge are specially designed lighting standards and railings on the main span. Bethlehem Steel Company fabricated and placed the railings. Pfaff and Kendall, Newark, N. J., produced and installed the lighting standards. Six different types of lighting installations are in place on the approaches and main span.

Aluminum is used for grating for three-foot safety walks on each side of the bridge. Irving Subway Grating Co., Inc., Long Island City, N. Y., fabricated the walkways from nearly 63,000 pounds of aluminum. Southwest Ornamental Iron Company, Kansas City, Mo., furnished the access ladders and inspection walks. Freedom from maintenance, as well as light weight, promoted the use of more than 110,000 pounds of aluminum in these applications. An aluminum chain-link fence at the toll plaza area required over a mile of seven-foot-high barrier, utilizing over 10,000 pounds of metal for this one item.

The "TEN COMMANDMENTS" of WATER WORKS DESIGN, CONSTRUCTION and OPERATION

These ten important principles in the design, construction and operation of water works have been selected by the author on the basis of forty-four years of engineering experience and association with more than 200 water supplies.

JOHN A. FULKMAN
Water Supply Engineer,
Consoer, Townsend & Associates,
Chicago, Illinois

IN THE FIELD of water supply engineering we may prepare a list of so called "Ten Commandments" or important principles, the observance of which will help produce satisfactory water supplies and will provide economies during present construction and in the future. Others may have additional important principles. However, the following "Ten Commandments" are given for what they may be worth to those engaged in the public water supply profession.

1. Secure and use in predictions for design records of past water use and pumpage for 10 to 30 years.
2. Estimate the future population and water use, each 5 years to ultimate, or at least for 30 years in the future.
3. Design and construct those water facilities that are expensive to expand or to duplicate for ultimate capacity, and those facilities that can economically be extended for 10 to 15 years in the future, or about 50 percent greater than present capacities.
4. Design and construct for maximum daily capacity plus fire protection requirements.
5. Include instrumentation and automatic control for indicating and recording water pumpages, pressures, power used, water levels in storage and similar functions and for remote control.
6. Provide stand-by equipment for emergencies.
7. Provide for construction costs and contingencies; land and right-of-way; engineering, inspection, legal and other overheads and interest during construction in the estimated project cost.
8. Provide effective financing, through general obligation, water revenue bonds, or otherwise.
9. Assure adequate and balanced water rates.
10. Keep operation records and size and location records of facilities.

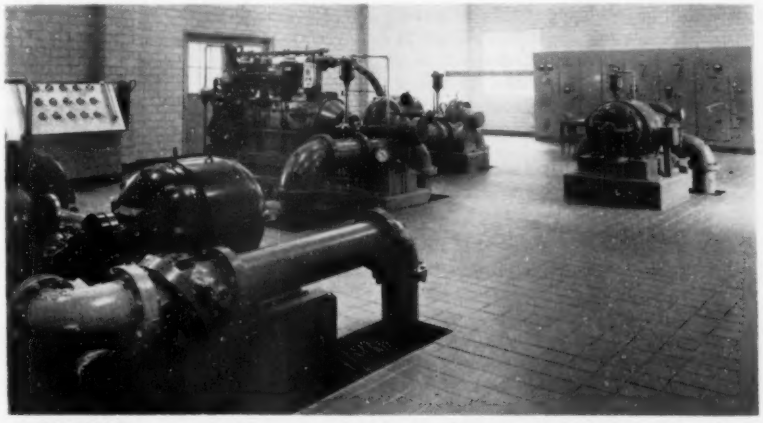
Water Use and Pumpage

In designing additions to an existing water works it is important first to secure, tabulate and study the past water use and pumpage for at least 10 to 30 years, if available. If the records are not complete, or if the project is a new water works, obtain the best data available and make estimates from other similar projects.

Secure where possible for each year the maximum hourly rate, the maximum daily water use, and average daily water use. In considering design capacity, the maximum hourly and maximum daily water use are the most important. The average water use is important when considering the annual income and water rates.

Useful information can be gleaned by tabulating or making a diagram of the hourly water consumption rates on the maximum day. The writer prefers a graph or mass diagram, plotting the hours horizontally and the hourly use in million gallons per day vertically. From such a diagram, with the average for the maximum day shown horizontally, the hours when water use was above and below the average become evident.

The block of the diagram above the average rate on the maximum day is the total storage desirable. This storage is used during the peak day hours and is replaced during the low water use hours or night. Additional storage must be provided for fire protection. The ideal design provides enough storage for operating the treatment plant, pumps, wells, etc., at a uniform rate for the maximum day. Storage is usually more economical than having plant facilities for taking care of large or maximum hourly water use rates. It is axiomatic that water facilities



● **STANDBY equipment for emergencies is one "commandment." An engine-driven standby pump is shown at rear center in this view of the Elkhart, Ind., pump station.**

other than storage must have capacity for providing for the average maximum daily water use. Such capacity should be provided for the present and for the future time for which the facilities are provided.

Future Estimates

Future population can be projected from past growth of the municipality and from the past growth of similar larger cities. It is always necessary to take into consideration the area available for future residential, industrial and other growth and for the results of future zoning. The local official opinion of future growth should also be considered though sometimes it is a little optimistic.

Water use per capita has been increasing during the last few decades and no doubt will continue to increase in the future. The writer is somewhat hesitant about giving any specific figure for this increase in future water use. However, from the studies of a number of cities for the past 10 to 15 years it has been concluded that in general the increase has been about 1 percent per year. Such an amount has been used for projecting future water use in several instances.

Design Capacities For Future

Designing for the future may be divided into two categories: 1) Design for ultimate capacity such water facilities as lake or river intakes, supply lines, and distribution system feeder mains, that are expensive to duplicate or increase; 2) design, for several years in the future (10 to 15 years) or about 50 percent larger than present capacity, facilities that can be extended such as treatment, pumping stations, wells, water storage and distribution systems.

Sometimes it appears better to design for a given percent greater than the present capacity. Then if you are around 10 or 15 years in the future and the predicted increase does not occur, you cannot be proven wrong.

Fire Protection

To meet the requirements of the National Board of Fire Underwriters for water available for a municipal supply at a residual pressure of 20 psi, sometimes 10 psi for large cities, include the amount required for fire protection and the average water use rate on the maximum day of the year. The rates at which water for fire protection must be supplied for 10 hours are 3,000 gpm for a population of 10,000, 6,000 gpm for 40,000, and 9,000 gpm for 1,000,000.

Providing water storage facilities to meet these standards of maximum capacity is economical. It permits the water protection facilities and treatment plant to be much smaller than would be required without ample storage.

The type and location of the storage is a matter of individual analysis for each city. However, some general principles are as follows:

1) Some or a considerable portion of the storage should be on the opposite side of the distribution system from the pumping station or source of supply. This permits the distribution system feeder mains to be smaller than they would be if all water were supplied in one direction from the source of supply.

2) Economics usually dictate that much of the water storage should be at ground level rather than elevated.

3) Elevated storage in tanks or standpipes is usually economical for supplying the amount of water above the maximum 12-hour daytime average for the peak hour or two-hour use.

4) Elevated storage often can be provided economically in the top third of a standpipe. This is true because the bottom two-thirds of the storage usually can be used for additional storage by booster pumping to the distribution system during maximum daytime periods.

5) Circular steel ground storage tanks, with the bottom at ground level, are an economical means of providing storage.

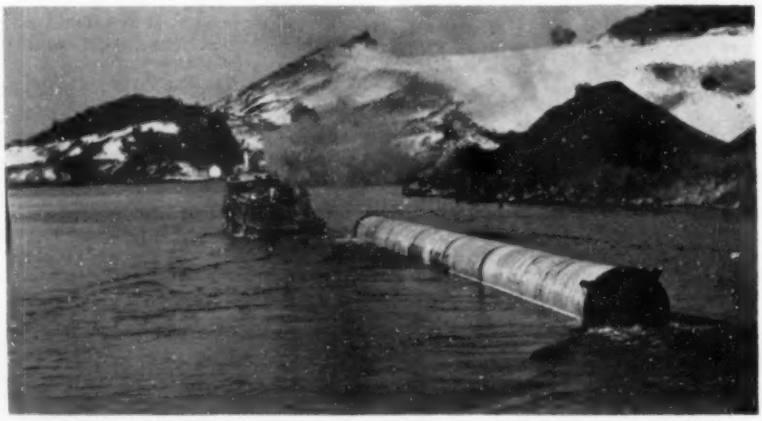
6) When the source of the water supply is a couple of miles or more distant from the distribution system it is usually advisable to have much of the water storage on the distribution system. This permits the transmission or supply pipe line to be operated at a rate near to the average for the 24 hours of the day.

Only a small percentage of the water works in the United States can meet the above capacities for fire protection on the day of maximum water use. More of them can meet the requirements for water source and storage. The capacity of the distribution system is usually the weak link. All phases of a water works must have sufficient capacity; an analysis of the facilities usually shows some part which is inadequate.

Instrumentation and Controls

Instruments for recording and indicating water pumpage and use; pressures at pumping stations and on the distribution system; power consumption including current and voltage if electric power is used; water levels in storage; and other similar functions have always been desirable and necessary. Good and complete records are of great value in predicting design capacities for future additions.

Automatic control of remote water facilities and even main pumping stations and treatment facilities are becoming more desirable and economical with the rapidly increasing labor costs. When considering additions and improvements or new facilities, a careful study and analysis of the automatic equipment that is available should be made.



● **TOWING a 54-inch intake pipe into place along Lake Michigan shore. Ultimate capacity should be the design basis for facilities expensive to expand or duplicate.**

Stand-by Equipment

It is wise to provide stand-by equipment for several of the vulnerable functions of a water works. Some of these functions that should be considered are sufficient pumping capacity to permit the largest

(*Continued on page* 190)

● TEAM composed of ¾-yd. dragline and crawler tractor handles sanitary landfill in marshy area at Elmhurst, Ill.

SANITARY LANDFILL PROJECTS

Serve both City and Contractor

LOCATING areas suitable for open dumping has become almost impossible in many municipalities. No suburbanite wants such a thing in his neighborhood and long distance hauling of refuse is expensive. The solution is close-in sanitary land fill projects. As an illustration of such a system let's examine the origination and function of the Van Der Molen Development Company of Melrose Park, Illinois (a suburban Chicago community.)

Some forty years ago the Van Der Molen Disposal Co. was formed. Operating as a family team, they have constantly expanded their firm so that it is now considered the largest waste disposal organization in the metropolitan Chicago area, serving ten nearby municipalities with complete scavenger service.

In 1948 the problem of finding suitable dumping areas became so acute that some other disposal system had to be found. The sanitary land fill method was decided to be the best and the Van Der Molen Development Co. was formed to manage and operate such a project. A 90-acre tract of swamp land and two pieces of equipment were purchased for this purpose, a ¾-yd. Marion dragline and a Caterpillar D-7 tractor dozer for distributing and compacting the waste material.

The process consists of trenching an area, filling the cut with disposable waste, compacting it and then sealing it off with a layer of subsoil at the end of each work day. Thus there is no rodent attraction, odor producing or unsightly open dump. DDT is often sprayed over the refuse before it is sealed by the sub-soil as a further precaution against insects. The dozer is used to compact the material at the end of each day. After several layers of refuse and sub-soil have been pressed into the cut it is leveled off with top-soil and planted with grass. The intermediate compaction of the individual layers insure the area from settling and shrinking.

The original 90-acre tract proved an enormous success and to date 30 acres of swamp land has been recovered. A second area is currently being filled for the City of Elmhurst.

This 46-acre site, owned by the Elmhurst Park District and located inside the city limits, was to be used for a future park location. However a creek running through the lowland property caused spring flooding and the site could not be developed. Disposable refuse was being hauled to open dumps some 16 miles away.

Edward Van Der Molen offered a sanitary land fill project to solve both the high cost of long distance hauling of refuse and the filling of the lowland area so the park could be developed.

At the first mention of the project, eyebrows were raised by the city fathers but a careful educational program aimed at the Elmhurst citizens obtained the consent of the city on the condition that Van Der Molen Development would vacate the site within 24 hrs. should the project prove offensive to nearby home owners. It didn't and the site has been in continuous operation since July, 1956. Van Der Molen estimates that the restoration of the park site will be completed in another year and the park then ready for development.

Working on the Elmhurst project is a Marion Type 35-M dragline carrying a 45-ft. boom and a ¾-yd. Page bucket. A Caterpillar crawler tractor is used for distributing the refuse and for compacting the daily fill. The Marion dragline excavates the cuts and refills with layers of sub-soil. Some 1500 yds. of waste are dumped daily at Elmhurst by Van Der Molen's 35 refuse carriers.

● **FREQUENT mowing keeps the Garden State Parkway looking like a park. Here a Lilliston rotary works on central mall.**

MOWING
The Nation's Biggest Lawn

GRASS on the wide shoulders and median strip of the Garden State Parkway covers an enormous total area along the 173-mile length of New Jersey's newest superhighway. Because of the varying widths of the dividing island and the grass-covered shoulders it is not possible to arrive at a precise figure, but it has been estimated that the area mowed by Parkway maintenance forces is in excess of 12,000 acres. Coupled with generally favorable growing conditions, this means that crews on the Parkway probably cut more grass than any other public agency.

There is a twofold purpose for these extensive mowing operations —beautification and prevention of soil erosion. Fortunately the two go hand in hand, since regular mowing promotes a dense turf that effectively stabilizes the soil on embankments, as well as maintaining the best possible appearance.

● **DRIVER demonstrates the heavy duty breakaway feature of the Anderson hydraulic mower. The cutter bar swings back undamaged if it hits an obstruction, and is easily repositioned by backing the tractor. The operator does not leave his seat.**

Modern superhighways brought with them a type of mowing problem not generally encountered on older highways which have relatively narrow shoulder and median strips. On the Parkway, the central mall varies greatly in width and in some places the two roadways are separated by as much as 600 feet. In naturally forested areas many trees growing in this wide center island were left undisturbed, but in other sections the entire width of the island is planted with grass. Even where wooded areas fill part of the central mall, there are wide grass strips between the roadways and the trees. Similar grass areas of varying width range along both outer shoulders of the Parkway.

Putting the "Park" in Parkway

How far should this mowing business go? Should the shoulders look like a golf course, or should mowing be confined to a narrow strip? A committee set up for the purpose of establishing a mowing policy, consisting of the Executive Director, Chief Engineer, Landscape Supervisor, and Superintendent of Maintenance determined that the practical and aesthetic benefits of clean, wide shoulders and neatly mowed center islands were desirable. As they pointed out, users of this toll facility demand and deserve something better than minimum standards of roadside appearance. As a result of this philosophy and

their efforts, the motorist's eye meets refreshing expanses of green grass and travel is in a pleasant, park-like atmosphere.

Of even greater importance is the ability of good solid turf to protect slopes against erosion. Where mowing operations are properly scheduled, root growth is promoted and the surface becomes well stabilized. This effect is clearly demonstrated when the first cut is being made in newly seeded areas. At this time tractors are most likely to bog down or cause damage to embankments by ruts or sideslips. After the first couple of cuts, however, the grass roots have branched out and stabilized the surface to such a degree that mowing equipment rarely causes damage, even on very steep banks.

In the design of the Parkway, great emphasis was placed on the use of gentle curves and changing vistas to relieve the hazardous monotony of straight-line, high speed travel. Vegetation was stripped from wide areas to accommodate the considerable sections of cut and fill required by minimum grades and long-radius curves. Numerous overpasses for secondary roads were installed, and interchanges were established. All of this work created new embankments, many of which are quite steeply sloped. The erosion resistance of a firm turf on these areas far outweighs the cost of a mowing schedule designed to keep the grass in a healthy condition.

Developing Mowing Technique

Initially the Parkway's maintenance department had neither experienced crews nor equipment to handle the mowing work, so it was fortunate for them that the Parkway was opened to the public a section at a time as construction was completed. This enabled them to develop their organization and to select equipment that would handle their mowing problem most effectively.

● **EXPANSE of grass-covered areas is illustrated by aerial view of the Parkway.**

As a preliminary step, Parkway officials visited several neighboring states to observe mowing techniques used by highway departments and other toll road facilities. Following this, a number of mower manufacturers were invited to demonstrate their equipment on the newly-opened Parkway sections so that performance of each type of machine could be evaluated. As a result of these investigations, the Parkway subsequently purchased from successful bidders Oliver wheel tractors, hydraulically powered Anderson sickle bar mowers and John Deere and Lilliston rotary mowers, plus smaller hand equipment, which qualified with their requirements.

Before embarking on a program of mowing by force account, the possibility of contract mowing was considered. However, this approach did not prove feasible because the irregularity of the center island width and the varying size of roadside bays made it impossible to reduce costs to a unit price based on mileage or area. Some preliminary bids were received, but as a result of the unusual work involved they amounted to a sum in excess of what the Authority proposed to spend for this Parkway operation. Moreover, these bids were based on an average of five grass cuttings per season; actually eight to ten cuttings in some areas have been required to maintain roadside conditions that approach the standards set by the committee and Authority policy.

● **WITH HIS HAND on hydraulic motor controls, operator uses an Anderson mower to cut heavy growth near edge of wooded area. Reversing feature of the hydraulic motor quickly clears jam-ups. Note dual tires that give Oliver tractor extra stability.**

Maintenance Organization

As new sections of the Garden State Parkway were opened to the public and the total length increased, the maintenance organization developed to keep pace with the job. Now maintenance operations are handled by five districts with headquarters at Telegraph Hill near Red Bank, New Jersey. Each District Supervisor has at his disposal personnel and equipment in proportion to the work to be performed. This places larger amounts of equipment in the sections where growing conditions are most favorable. Each district uses the same types of machines, which reduces to a minimum the quantity of replacement parts that must be kept in stock.

The mowing season in New Jersey starts about May 1 and sometimes continues into November. Frequency varies with weather conditions, but most districts require five to six cuts per year. The grass is usually not cut lower than two inches at any cutting.

Because of budget limitations, each District Superintendent must utilize his equipment and labor force to the fullest degree possible to keep grass areas in good condition. It takes three to four weeks, on the average, to train a new

driver, and even then proficiency varies a great deal. Some operators are quick to learn the capabilities of each piece of equipment and are able to work on steep banks and in difficult terrain without mishap. By keeping these capable operators busy on mowing assignments the work is done with a minimum of equipment repair and without the need for re-grading rutted embankments. Unfortunately, there are other drivers who seem to have an uncanny knack for mowing over stray wires that tangle cutter blades, running into hidden obstructions or getting tractors bogged down in soft ground. This puts equipment in the repair shop and slows down the work, usually at the busiest times. Naturally any drivers who habitually cause breakdowns due to carelessness are soon assigned to other duties. The fact that such "other duties" includes cutting with hand scythes in areas inaccessible to power equipment probably acts as a deterrent to heedless operation.

Mowing gets special attention since it is one of the largest jobs handled by the maintenance department. When the maximum amount of mowing is under way, over 100 men, or about 75 percent of the entire maintenance force, is engaged in this operation. Constant supervision is required to ensure a uniform job in all areas, for even limited over-grown sections can detract materially from the appearance of the Parkway as a whole.

Mower Features

Most of the mowing equipment now in use was acquired in 1955 following the initial demonstration period on new Parkway sections, and are now in their fourth season of service. Each type of mower, and the tractor as well, has features which make it especially well adapted to the severe service requirements of Parkway mowing.

For instance, an important advantage of the twenty Anderson mowers is the hydraulic power system which delivers a constant volume of oil to the hydraulic motor regardless of engine speed. This type of drive prevents over-speed and eliminates vibration which would damage parts and fatigue the driver. Hydraulic power also is used to adjust cutter bar angle from 45° below horizontal to 90° above and to regulate its height from 0 to 15 inches through the parallel lift arrangement. By reversing the hydraulic motor, jam-ups are quickly cleared, and damage from hidden obstructions is largely eliminated by a heavy duty breakaway that allows the cutter bar to swing back.

Both the Lilliston and John Deere rotary mowers are towed behind the tractor and operated through the rear power takeoff. For mowing in open areas the big Lilliston rotaries do a fast job by cutting a 96-inch swath. These machines have twin cutter blades mounted in parallel and driven by V-belts. In more restricted areas, especially where there are numerous obstructions, the John Deere mowers are put to work. These are equipped with a lifting mechanism that enables the driver to raise the mower clear of rocks and other obstructions.

Thirty of the Oliver Super 55 wheel tractors now in use were purchased in 1955. More tractors of this model were added to the fleet this year, since Parkway officials have been well pleased with the performance of these machines. Excellent stability is obtained by using dual rear wheels and by moving the adjustable front wheel treads outward. This reduces the danger of operation on the side of steep slopes and gives the flotation necessary to prevent damage to soft new turf. Besides the mowing operations, these tractors are used with rakes and post hole diggers.

Both a side-mounted Anderson mower and a rear-mounted rotary can be attached at the same time. This speeds the grass cutting job and also permits the driver to continue operations with one machine when some temporary disorder puts the other unit out of service.

As mentioned above, irregular areas and the necessity for extra hand work in the vicinity of guard rails, around ornamental plantings and the like make records of operating costs difficult to obtain. Regular servicing and complete off-season overhauls have held equipment maintenance costs at a low level, while standardization of equipment has reduced the variety of spare parts needed.

"Know-How" and Equipment

Many of the operators have developed remarkable proficiency, and when this is coupled with the right equipment for the job, results are outstanding. This is illustrated by work done in 1957 on the new northern extension of the Parkway to the New York State line, where it connects with a spur of the New York Thruway. Ordinarily the first cut in a new section is the responsibility of the contractor who does the final grading and seeding work. However, as opening day for this section approached, the contractor found that it is exceedingly difficult to cope with badly overgrown soft new embankments without the proper tools and trained personnel. Rather than allow the new section to be opened with such untidy roadside conditions, maintenance crews were directed to move in and do the job right. Careful advance planning distributed crews and equipment along the new extension, and with steady, unhurried work the job was soon completed. This performance amazed the contractor's crews, who had experienced many delays from stalled equipment and breakdowns.

The Challenge

In the determination to make the Garden State Parkway live up to its name, it is found that budget limitation is the most serious problem. Nevertheless, aside from the perennial restrictions of working without unlimited funds, it has been shown that the selection of the proper tools, good training of personnel and careful organization of the department can produce well stabilized, eye-pleasing roadside vistas. High standards of past performance are a source of satisfaction as well as the greatest challenge for the future.

● **THREE Oliver tractors equipped with John Deere rotaries and Anderson sickle bar mowers work in tandem on one of the large grass areas adjacent to the Parkway.**

SEWAGE TREATMENT *with* TRICKLING FILTERS

TRICKLING filters have made a remarkable record in the treatment of sewage and industrial wastes. Their adaptability to varying organic and hydraulic loadings and to the treatment of industrial wastes has resulted in wide usage. Many variations in design have been developed capable of producing almost any desired end results. All of these variations, however, appear to retain the ability to operate in cold weather or in hot, or with overloads, with only reasonably skilled supervision.

Certain conditions are necessary for most effective operation. These include: (1) Proper pretreatment of the waste to remove solids, usually attained by passage through a sedimentation tank; (2) reasonably uniform application of the settled waste to the surface of the filter, as by a rotary distributor or spray nozzles; (3) use of properly sized filter media, free from fines and substantially uniform in grading; (4) provision of underdrainage facilities for the prompt and complete removal of the material passed through the filter bed; and (5) assurance of adequate ventilation so that each unit of the filter receives the air needed for the oxidation process.

Filters are classified according to the organic loading for which they are designed, as high rate or low (or standard rate); and by depth, as deep or shallow.

The amount of organic loading, in pounds of BOD applied per cubic yard or acre-foot of media determines whether the filter is to be termed high rate or low rate. Though there is no definite standard, a generally used loading for a low rate filter approximates, as a maximum, 600 pounds of BOD per acre-foot, or 0.375 pound per cubic yard. Though many low rate filters are carrying heavier loadings, they were not generally designed to do so initially. High rate filters are usually designed for an applied loading, based on settled sewage strength, of 2,000 to 3,000 pounds per acre-foot or 1¼ to 1¾ pounds of BOD per cubic yard.

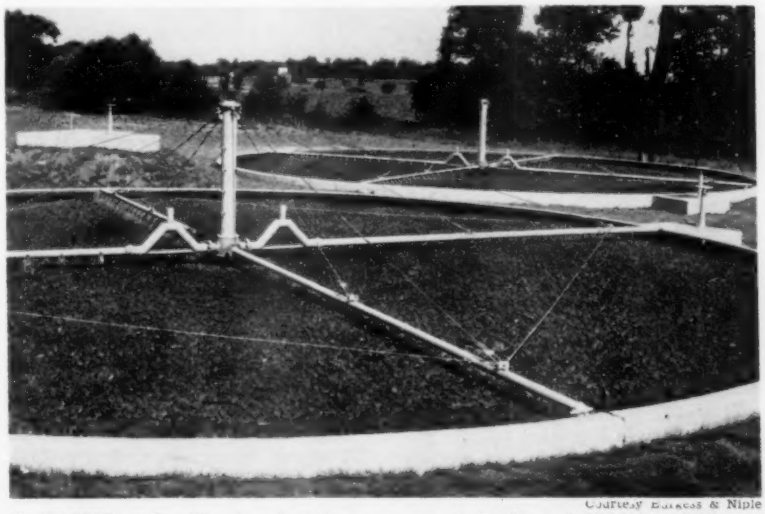
This article is a chapter of the forthcoming revision of the ***HANDBOOK OF TRICKLING FILTER DESIGN***

Much heavier loadings are being applied in some places. The preliminary filters at the Charlotte, N. C., treatment plant carry a loading from combined sewage and industrial waste flow of 9,000 pounds of BOD per acre-foot. In many two-stage plants, the primary filter loading is often as high as 6,000 pounds of BOD per acre-foot or 3.75 pounds per cubic yard.

An increasing number of plants have been operating in the intermediate zone of loading—between 600 and 2,000 pounds of BOD per acre-foot. As a result, operational data are accumulating. The data, though not yet as voluminous as might be desired, indicate that the inherent characteristics of a trickling filter exist in each unit, despite the details of design. It is further indicated that good results are always likely in a well-designed plant largely irrespective of the loading, though the quality of the effluent may vary somewhat. This statement is borne out by experiences in Dallas, Tex., and Fallsburg, N. Y. In Dallas, groups of filters of 176-ft. diameter were loaded at rates of 790 to 3,404 pounds of BOD per acre-foot. Effluent BOD ranged from 25 mg/L to 51 mg/L. The average for the 7-month run of the lowest loaded group was 32.8 mg/L BOD with an average loading of 1,090 pounds per acre-foot; and for the highest loaded group—2,608 pounds of BOD—it was 40 mg/L.

In Fallsburg, a 90-ft. low rate filter 9 ft. deep was converted to a high rate filter with recirculation. Apparently overloaded under the original condition and producing an effluent with about 90 mg/L BOD, the change to high rate resulted in a BOD of about 30 mg/L in the effluent. Minor changes in other plant units may have been a factor in the improved operation.

Just as in the case of organic loading, there is no clear line to distinguish deep from shallow filters. A



Courtesy Burgess & Niple

● **FILTERS at Orrville, O., plant have an organic loading of 2150 lbs. BOD per acre-foot and hydraulic rate of 6 mgad. Filters are 5 ft. deep and 68 ft. diameter.**

generally used standard in respect to depth considers a filter in which the media is less than 4.5 ft. in depth as a shallow filter; and one with media more than 4.5 feet in depth as a deep filter. The depth is the average distance from the top of the underdrain floor to the top surface of the filter media.

A cutaway section of a typical trickling filter is shown below. In this, A is the concrete floor of the filter; B and B are the blocks providing underdrainage and ventilation; C and C are the walls which contain the filter media D, which is usually rather coarse broken stone or slag; E is the support for the distributor F which applies the sewage to the filter surface. Stabilization of the organic matter in the sewage is accomplished by aerobic bacteria present in the filter and by chemical action in the course of the very few minutes required for the sewage to trickle down through the bed of coarse stone.

Definitions and Abbreviations

For the purpose of this text, the abbreviations shown in Table 1 will be used. Definitions of other terms used are as follows:

The *organic load* on a filter is the BOD content in pounds that is *applied* to the filter. It is usually the BOD content of the raw sewage less the BOD that is removed by the pretreatment devices such as screens and clarifiers. For instance, if the sewage flow is 1 million gallons per day and the BOD of the raw sewage is 240 mg/L, the total BOD will be 2,000 pounds. If 30 percent is removed by primary treatment devices, the organic load applied to the filter will be 2,000 x 0.70 = 1,400 pounds BOD.

The *volume* or *hydraulic* loading on a filter is the amount of sewage or waste applied to it, computed on the basis of millions of gallons per acre of filter surface per day. If the sewage flow is 1 mgd and this is applied to a filter which has a surface area of 0.10 acre, the volume loading will be 10 million gallons per acre per day.

Table 1—Abbreviations

5-day Biochemical Oxygen Demand	BOD
Suspended Solids	SS
Gallons per minute	gpm
Gallons per day	gpd
Million gallons per day	mgd
Gallons per person per day	gpcd
Acre-foot = 43,560 cu. ft.	af
Million gallons per acre per day	mgad
Milligrams per liter	mg/L

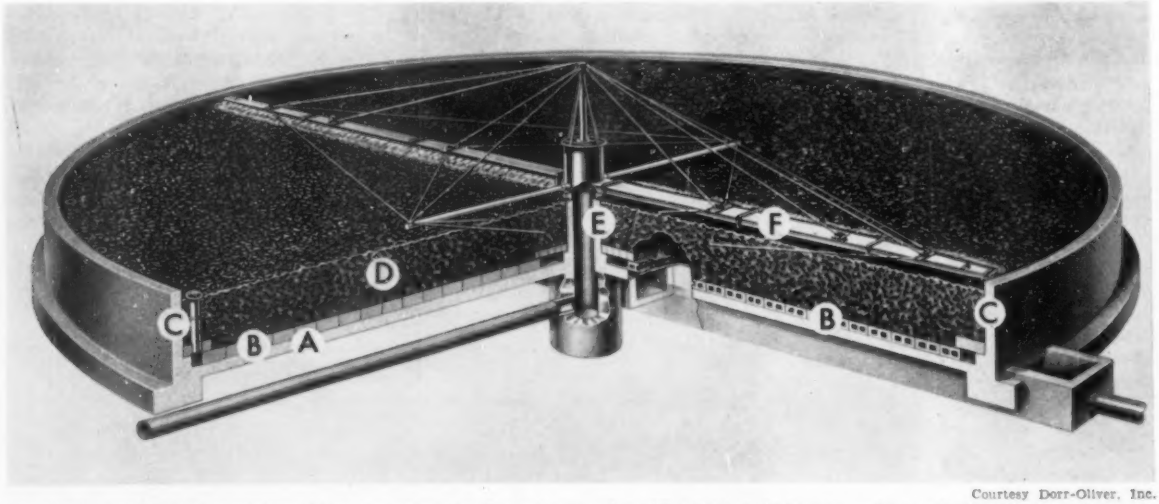
A *low-rate* or *standard rate* filter is one in which the organic loading in terms of pounds of BOD per acre-foot of filter media does not exceed 600; a *high rate* filter is one in which organic loading, expressed as above, exceeds 1,600 pounds. An *intermediate rate* filter is one that has a loading between 600 and 1,600 pounds per acre-foot of media.

A *single-stage* filter is one in which treatment is accomplished by one or more passes of the sewage through the filter. This term is usually restricted to high rate filters using recirculation. If there are two or more filters in a single-stage plant, these filters are operated in parallel. In a *two-stage* filter system there are two filters in series, with the effluent from the first or primary filter being passed through the secondary filter. Recirculation is usually employed on both filters. Large two-stage treatment plants may have four, six or more filters, each pair of them working as a team.

Recirculation is the return of a portion of the sewage or waste which has already passed through the filter, and sometimes also has been settled, for another passage through the filter. This return may be directly to the filter or it may be to the inlet of the primary settling tank.

The *primary clarifier*, *primary tank* or *primary settling tank* is the sedimentation device ahead of the filter which pretreats and prepares the waste for application to the filters. An *intermediate clarifier* or *tank* is the sedimentation device between any two filters. A *secondary clarifier* or *secondary* or *final settling tank* is the sedimentation device following the final filter. This usually provides the final treatment for the waste except for chlorination. Where a high degree of treatment is necessary, a sand filter may be provided following the final clarifier: but with increasing knowledge of trickling filter design, and the ability to obtain almost any desired degree of treatment, such units are now seldom used.

In considering trickling filters, the filter or filters and the following clarifier should always be considered as a unit in both design and operation. There is no place in sewage treatment for a trickling filter without a final clarifier in which to settle the filter effluent. (This does not apply to the first stage filter of a two-stage filter system.)



Courtesy Dorr-Oliver, Inc.

● **ALL ELEMENTS of a tricking filter are shown in this cutaway view. The letters designate major parts described in the text.**

Other Units of Expression

The Subcommittee on Standardization of Units of the Federation of Sewage and Industrial Wastes Associations Committee on Practice has recommended simplification of many terms now used in sewage treatment. Those referring to trickling filters include the following:

Hydraulic load, including recirculated flow if used, in gallons of flow per square foot of surface area of the filter. The low rate filter range will be 25 to 100; the high rate range will be 200 to 1,000. The rate in million gallons per acre per day multiplied by 23 will give gallons per square foot per day. Thus a rate of 20 mgad equals 460 gsfd.

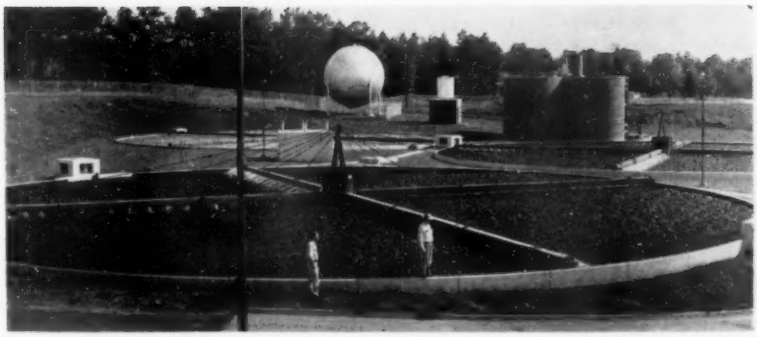
BOD load is expressed in pounds of BOD per day per 1,000 cu. ft. of filter volume, with a low rate filter range of 5 to 25 and a high rate range of 25 to 300. The rate in pounds of BOD per acre foot per day multiplied by 0.023 equals the pounds of BOD per 1,000 cu. ft. per day. Conversion from pounds of BOD per cubic yard per day to pounds of BOD per 1,000 cu. ft. per day is accomplished by multiplying by 37. Thus 2,420 pounds of BOD per acre foot, multiplied by 0.023 represents 55.6 pounds per 1,000 cu. ft., as does the equivalent 1½ lbs. per cu. yd. multiplied by 37. For high rate filters, the recirculated flow is not considered in contributing an additional BOD load.

Percentage of recirculation equals recirculated flow divided by waste flow multiplied by 100. The low rate filter range is 0 to 50 and the high rate range is 25 to 300.

Comparison of Filter Types

There is no essential difference in construction between the high rate and the standard or low rate filter. The same media, the same underdrains and the same ventilation facilities are provided in either case. The distributors are essentially the same, except that those used for high rate filters must be designed for larger volume rates of application. The potential BOD removal appears to exist in every filter; the rate and method of application of the sewage to the filter determines how and to what extent this potential is utilized. The high rate filter, because it is loaded much more heavily—the BOD loading may be three to six times as great as that on the standard rate filter—is correspondingly smaller and usually costs less to build.

There are differences in the quality of the effluents from high rate and low rate filters. The latter produce a higher degree of nitrification, so that strengths of effluents from the two types of filters, stated in milligrams per liter of BOD, cannot be directly compared. This is especially true of single-stage high rate filters; two-stage high rate filters may produce some degree of nitrification. However, local conditions usually govern in determining the degree of treatment needed and the actual reduction in the organic load discharged to the stream is a most important factor.



● **TRICKLING filters at the Irwin Creek treatment plant, Charlotte, N. C. These 125-ft. units level off peak BOD loadings resulting from industrial waste discharge.**

If local conditions dictate the selection of a plant to produce an effluent low in BOD, well nitrified and highly stable, full consideration should be given to a deep filter and a low rate of loading. If a less completely stabilized effluent is permissible, with a slightly higher BOD content, a single-stage high rate filter may be selected because it is usually lower in initial cost. If the waste is very strong and a good effluent is necessary, a two-stage filter may be preferable, since this combines many of the cost-saving features of the single-stage high rate filter with an effluent that may approach that of the low rate filter in BOD content.

Pre-Treatment

Standard practice is to provide pre-treatment ahead of filters by means of settling tanks, either round or rectangular, equipped with mechanical apparatus for removing the sludge and preceded by a comminutor and properly cleaned screens. Imhoff tanks may be used for small installations; however, the depths necessary for proper Imhoff tank design may result in a high initial cost; and operating care and attention are just as necessary for an Imhoff tank as for any other sedimentation process.

Standard practice usually provides for a detention period of about two hours in the primary settling tank for design flow plus recirculation, in the case of a high rate filter. However, there is considerable variation in requirements among the several states and the applicable regulations should be determined and followed. There seems to be little justification, when primary tanks are to be followed by filters, for the costly requirements of some states which restrict weir overflow rates on primary tanks ahead of filters to 10,000 to 15,000 gallons per foot of length per day.

Surface overflow rates, tank depths and other factors are also subject to state regulations and these may vary materially among the states.

In the treatment of cannery wastes and creamery products, some engineers use a fine screen and a small equalizing tank for pre-treatment instead of the usual primary tank. This is based on studies and observations which indicate the "microbial forest" on the filter media can treat any material not large enough to interfere with the application of the sewage to the filter.

Intermediate and Post-Treatment

Intermediate clarifiers have been used in a relatively small number of plants. They are of most value where the sewage or industrial waste is very strong. Detention periods are usually somewhat less than for primary clarifiers. Few states have regulations covering intermediate clarifier capacity, but it is desirable to consult the sanitary engineering division of the state having jurisdiction.

The secondary clarifier is the key factor in the design of filters for best operation. It is not the function of the filter to remove suspended matter, but to change this to a relatively stable form. This material, and the spent gelatinous film which sloughs

off the filter media, continuously in the high rate filter and from time to time in the low rate filter, must be removed by the clarifier.

As with primary tanks, the detention period, overflow rate, weir overflow rate and tank depth of the secondary clarifier are subject to state health department regulations. In general, detention periods of 2 to 3 hours should be provided for design flow plus recirculation, if the secondary clarifier is involved in the recirculation process. Where recirculation is used, the necessary volume may be taken from a launder installed in the secondary tank.

Effects of Temperature

Trickling filters operate better and produce better effluents in warm weather periods. However, though they are affected in some respects by low temperatures, extreme cold is necessary to create any serious adverse effect. In the North Central States, it is fairly standard practice to provide covers, either of prestressed concrete or of wood, for filter units, for experience has shown that operating results are improved and troubles from icing are eliminated.

Cold weather effects may be of two kinds: (1) the surface of the filter may become iced; and (2) the efficiency of the filter in respect to BOD removal may be impaired.

In ice formation, to which snowfall may contribute, wind appears to be an important factor as it drives spray to the downwind side where deposits may build up. However, difficulties are restricted to the really cold areas. No such troubles were reported in the operation of uncovered filters at more than 300 Army posts during World War II, though some of these were located in low temperature areas.

It is good practice to provide bleed valves in the distributor support posts of rotary distributors and in the distribution system of spray nozzle installations so as to prevent freezing and consequent damage if the flow of sewage stops or becomes so small that the dosing siphons work only at long intervals. In some plants, a small pipe is tapped into the feed pipe at the distributor base and is left open all winter.

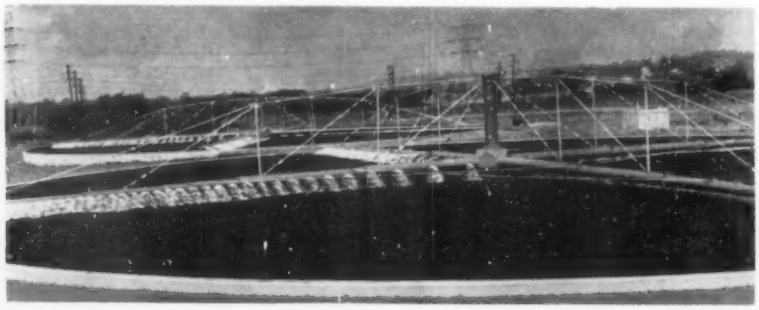
To determine the effect of temperature on the efficiency of BOD removal by low rate trickling filters, the records of nine military sewage treatment plants were studied by a Sub-Committee on Waste Disposal of the National Research Council. These were all standard rate plants. Results obtained in July, August and September of 1943 were compared with results in December, 1943, and January and February, 1944. With adjustment for differences in loading during the two periods, there was a small but significant drop in efficiency during the colder months, during which the air temperature averaged 38.1°F lower than the summer months. The subcommittee reports that: "With military sewage of the usual concentration, this difference in efficiency results in effluents with a BOD about 20 percent larger in winter than in summer."

On this basis, it was estimated that a filter should be about 43 per cent larger if it is to operate as well at an average temperature of around 40°F as the normal filter will operate during the warm summer months. The Army designs of World War II specified that filters in the northern states should be 25 percent larger than those in southern areas.

Few data appear to be available regarding the effect of cold on high rate filters. It is the opinion of the Editor, based on observations of several two-stage high rate filters in the Catskill Mountain area of New York State, that such filters are 20 per cent more efficient in the three warmest months of the year than they are during the four coldest months. They appear to be able to carry a heavier loading and to produce a better effluent during the warm months. However, in the Dallas study which continued from June, 1954, to May, 1955, there was no discernible difference in month to month results.

Olney Borden, consulting engineer of Liberty, N. Y., who has had wide experience in high rate filter design and operation, states that, in the Catskill resort areas, raw sewage BOD is lower in the winter. While filters operate at a lower efficiency during cold periods that persist for two weeks or more, effluents are about the same in quality as summer effluents because of the lower unit loading of the filter due to the weaker raw sewage.

Under the best of conditions, some time is required to build up the biologically active film necessary on the filter media. The time required depends on the temperature and probably on a variety of local conditions. Usually 3 to 4 weeks are required. If the plant is started late in the fall, when air and sewage temperatures are low, an even longer period will be required before adequate treatment results can be expected. A change from high rate to low rate operation, or vice versa, will probably require 4 to 6 weeks to develop the proper biological growth. Changes in rate of loading are also likely to require considerable periods before results truly reflect the change.



Courtesy Walker Process Equipment, Inc.

● **THREE 160-ft. diameter filters provide secondary treatment at Alexandria, Va. Each filter handles 10,500 gpm. Operating results have generally been excellent.**

Applicability

Trickling filters are applicable to weak or strong sewages and to many types of industrial wastes. By utilizing recirculation, whereby the incoming sewage is reduced in strength, even exceedingly strong wastes can be treated satisfactorily and economically. Recirculation may be applied to either high rate or low rate filters. High rate and low rate filters may be combined in a single treatment plant, a procedure especially adaptable to the production of an excellent effluent. In such cases, the high rate filter is used as the primary filter to remove as much as possible of the organic load; and the effluent from the high rate filter is applied to the low rate filter. Final treatment, following the high rate filter, may also be provided by an activated sludge plant. In either case, the high rate filter markedly reduces the organic load on the secondary unit and delivers to it a waste of uniform strength.

How CHLORINATION HELPS WATER CONDITIONING at ALASKA BASES

EDWARD W. LINGEL,
Captain, U. S. Air Force

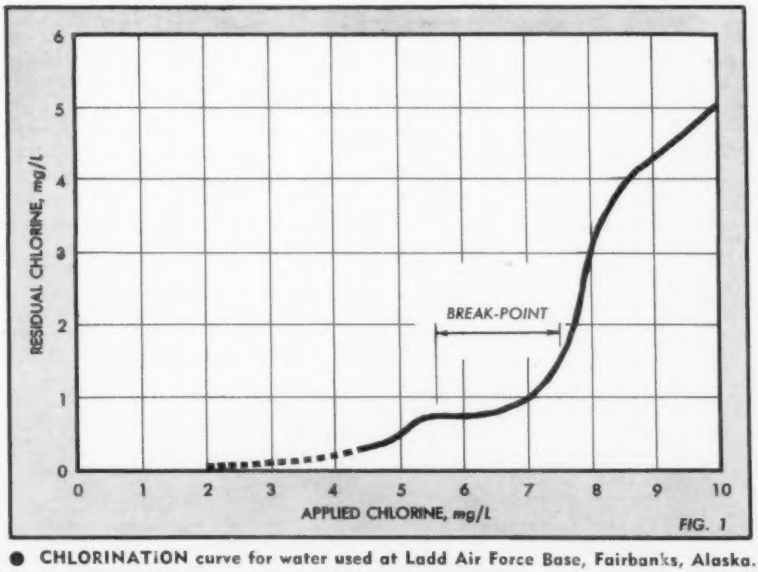
IF CHLORINE is added to water in increasing increments until a residual appears, and then more chlorine is added, the residual will increase until a point is reached where the residual suddenly drops. The residual will then increase again as more chlorine is added. The point at which the residual starts to increase again has been called the "break point." The residual chlorine measured before this break-point is combined residual chlorine. The residual measured after it is free available chlorine. After the break point, the residual chlorine will increase in direct proportion to, and at the same rate as, the applied chlorine, (i.e., for every mg/L chlorine added the residual will increase one mg/L). Some waters, however, do not exhibit a definite break-point.

The accompanying curves will illustrate the utilization of this principle in two Air Force Stations in Alaska. Figure 1 is a chlorination curve for the water used at Ladd Air Force Base, Fairbanks, Alaska. The water is obtained from wells and is characterized by a high iron content (about 3 mg/L). The Base water treatment plant was originally designed to remove iron and impurities by prechlorination (to oxidize iron to the ferric state), flocculation, settling and filtration. No provision was made for adding a flocculant. Water is filtered through three sand gravity filters. Operation of the plant, as designed, resulted in an excessive carry-over of fine iron floc to the filter beds. The floc particles clogged the filter beds in a relatively short time and it was very difficult to remove the imbedded floc particles by backwashing. Very fine floc particles and iron in the ferrous state passed through the filter beds into the distribution system causing red water and discoloration of plumbing fixtures. It appeared that the floc particles were not of optimum size to produce efficient settling. Data for the curve in Figure 1 were obtained from tests performed to determine the effectiveness of higher applications of chlorine for oxidizing the iron. It was believed that larger floc particles with better settling characteristics could be produced.

The Ladd Air Force Base test data were obtained from actual plant operating data. After the break-point was determined, the chlorinator was set to apply 6.8 mg/L (approximate break-point). The water in the settling basin was red in color which indicated that the chlorine was oxidizing the iron from its natural ferrous form to the ferric form. The iron content in the filtered effluent was 0.8, 0.8 and 0.2 mg/L for filters 1, 2, and 3 respectively. The relatively high iron content in the effluent from filters 1 and 2 was due to sulfuric acid which was being inadvertently added to the filters. The acid was dissolving the iron that had accumulated on the filter sand previous to the test. After the sulfuric acid was cut off, the iron content in the effluent from filters 1 and 2 decreased to a reasonable level.

From this test, it was concluded that although this type of chlorination process was effective in oxidizing iron, the flocculation and settling processes were not efficient to prevent iron carry-over. Further operating tests indicated that the plant would possibly require the addition of a rapid mixing unit or chamber, provision for adding a flocculant and enlargement of the settling basins to insure successful removal of iron.

Figure 2 is a similar chlorination curve for the water at Middleton Island Air Force Station, Alaska. Curve data were obtained from tests performed by Lt. Francis Riley, Chief, Sanitary Engineering Division, Alaskan Air Command, and the author to determine the effectiveness of break-point chlorination for removing tastes, odors and color. Water at Middleton Island is obtained from a million gallon impounding reservoir excavated in hard clay soil. Water consists primarily of surface runoff. The raw water was a tea color and smelled like a mixture of dead fish and a doctor's medicine cabinet. The odor in the water treatment plant was so intense that it was sickening. Although no chemical analysis was performed, there is every reason to believe that the water contained appreciable amounts of ammonia, since the reservoir is open and



● **CHLORINATION curve for water used at Ladd Air Force Base, Fairbanks, Alaska. Water is from wells; iron content is high; plant additions were needed for removal.**

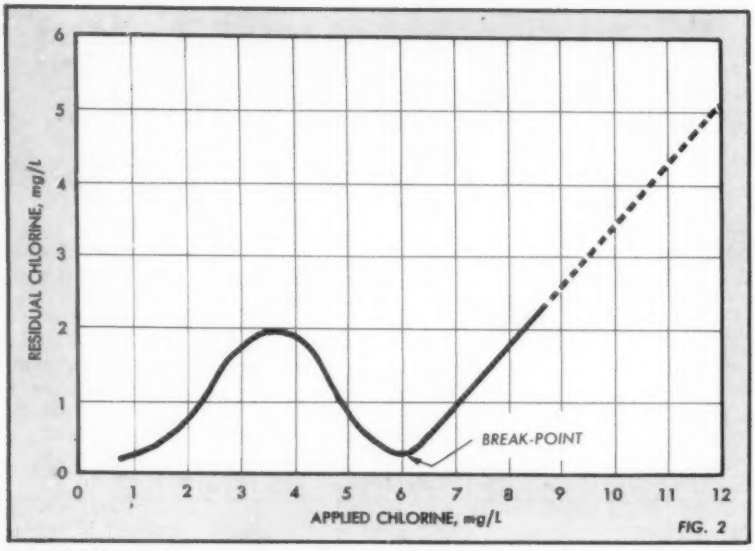


FIG. 2

● **CHLORINATION curve for surface water used at Middleton Air Force Base.**

serves as a convenient bath for hundreds of sea gulls.

Data for the chlorination curve, Figure 2, were obtained from laboratory tests using the orthotolodine colorimetric method for determining chlorine residuals. After the breakpoint was determined, 10 mg/L chlorine (hypochlorite solution) was applied to a sample of raw water to test the effectiveness in removing color. The sample was stirred and then allowed to stand for several hours. The water slowly cleared until very little color remained.

The water treatment process at Middleton Island consists of coagulation with alum; flocculation; settling (using Graver equipment); pressure filtration through sand and activated carbon; and post chlorination. In addition, lime and silica were added to improve coagulation. To test the effectiveness of chlorine to remove odors, about 10 mg/L chlorine was injected into the raw water at the point of its entrance into the treatment plant. The odor was immediately destroyed. During the test period, coagulation with alum was not used.

It is interesting to note the difference in chlorine demand between the two waters. "Chlorine demand is defined as the difference between the amount of chlorine added to water and the amount of chlorine (free available and combined available) remaining at the end of a specified contact period." The chlorine demand for the Ladd water was about 4 mg/L when 4 mg/L chlorine was added. The chlorine demand for the Middleton Island water was about 2 mg/L when 4 mg/L chlorine was added. Contact period was 30 minutes for the Ladd water and 1 hour for the Middleton Island water. These results were rather unexpected since a visual observation of the Middleton water indicated that it would have a higher chlorine demand (i.e., more than 2 mg/L). There was no doubt that the water contained a large amount of organic material, which contributes to a high chlorine demand. Further checking of the chlorine residuals after longer contact periods (2 hrs., 3 hrs., etc.) showed that the chlorine residual decreased. This indicated that the Middleton water did have an appreciable chlorine demand, although it was slow in developing.

FLUORESCENT STRIP LIGHTING FOR TUNNELS AT LONG BEACH AIRPORTS

WHEN Long Beach, Calif. extended the runway of its airport from 7,600 to 10,000 feet in order to accommodate commercial jet aircraft, two major traffic arteries had to go underground. The Lakewood Blvd. tunnel is six lanes wide and 904 feet long; the Spring Street underpass is four lanes wide and 1,083 feet long. In both, opposing lanes of traffic are separated by a curtain of reinforced concrete.

Illumination for the two tunnels was designed by Sunbeam Lighting, Inc., of Los Angeles and Gary, Indiana. A specially designed aluminum alloy and plastic fixture was used, housing three 72-inch fluorescent tubes. Each tube is enclosed by a hinged one piece extruded acrylic diffuser. Longitudinal 30° prisms on the inside surface of the diffuser direct light downward across the roadbed and along sidewalls where the need for illumination is considered greatest. With the diffuser in place the fixture is fully waterproof and able to withstand 150 pounds of direct water pressure. When closed, the diffuser and fixture are tightly sealed by a vinyl gasket.

In the two installations, 1,500 6-ft. fixtures were used—650 in the Lakewood Blvd. tunnel and 850 in the Spring Street underpass. Fixtures are mounted end to end on both sides of the tunnels at the juncture of wall and ceiling.

To provide high intensity illumination in the center portion of each tunnel, a triangular shaped common raceway was designed permitting the installation of two fixtures at 90° to each other. This common raceway appreciably reduced installation costs and is expected to simplify maintenance procedures. The dual fixture features near the center of both tunnels also make possible variable light intensities during the evening and early morning hours with consequent power savings and lower tube replacement.

● **UNDERPASS at Lakewood Blvd. has dual fixtures along the center section.**

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MUELLER

the complete line of water service equipment...

Mueller offers the complete line of water service equipment—a line backed by a century of manufacturing experience and technical "know-how". Specify Mueller, and you insure longer, more dependable service and reduced maintenance costs. One source of supply can reduce your costs and insure a system of components matched in quality and performance.

SPECIFY MUELLER

MUELLER CO. Since 1857 SERVING the Water and Gas Industries QUALITY

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Factories at: Decatur, Chattanooga, Los Angeles;
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ENGINEERED...

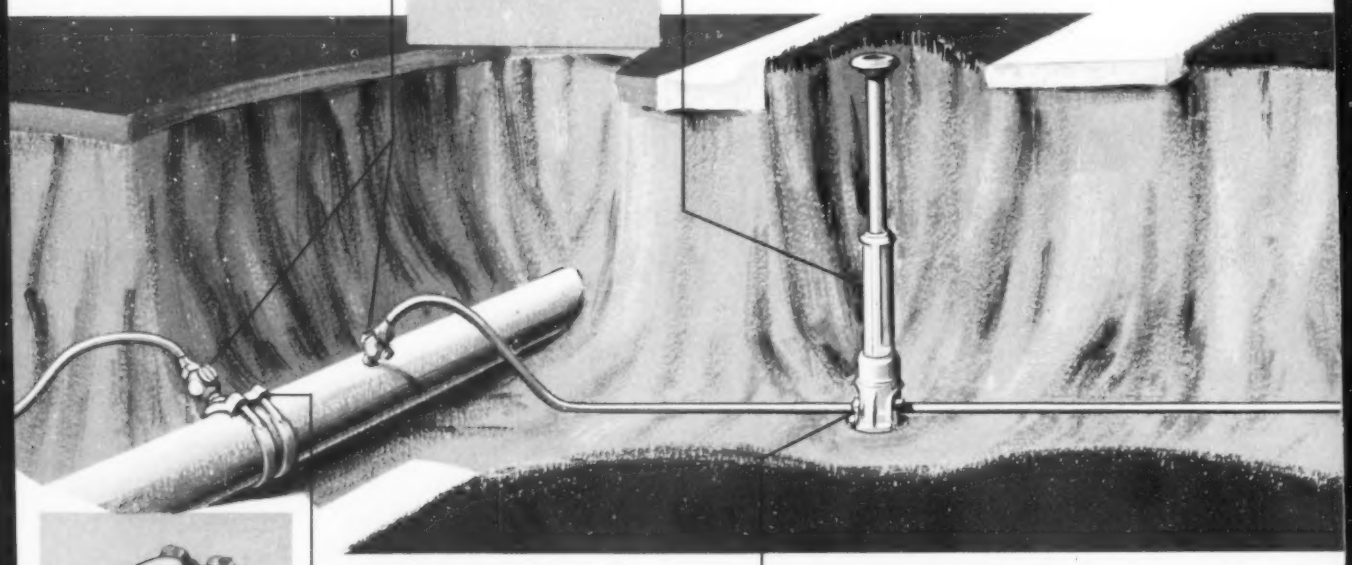
water service products

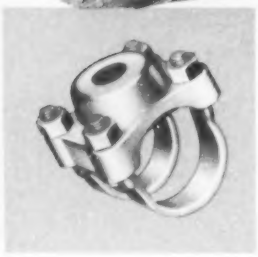
CURB BOXES

Telescopic type—prevents damage to stop or service piping . . . upper section slides in lower section . . . strong phosphor-bronze spring holds upper section in desired position . . . iron to bronze threads assure easy plug or lid removal . . . coated inside and out with tar base enamel to increase resistance to corrosion . . . with or without stationary rod.

CORPORATION STOPS

Quality ground-key construction . . . precision fitted and lapped . . . assures water-tight closure and ease of operation at all times . . . practically any end connection combination to meet every application.



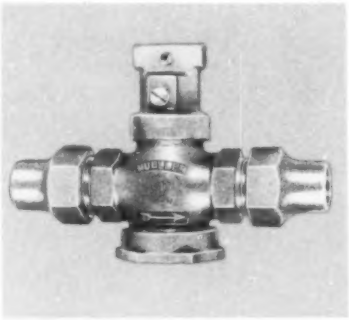


SERVICE CLAMPS

For quick, safe connections to any type main under pressure . . . heavily galvanized malleable iron bodies . . . flattened forged steel straps, cadmium plated, give maximum strength and rigidity for long life . . . single or double strap type for 1" to 12" diameter mains . . . full range of tap sizes.

CURB STOPS

Cast and machined from finest water works bronze . . . inverted key individually ground and lapped, seats with the pressure, assuring water tight closure . . . seating force increases with increase in water pressure . . . various combinations of inlets and outlets for any type of service pipe . . . sizes ½" through 2".



MUELLER CO.
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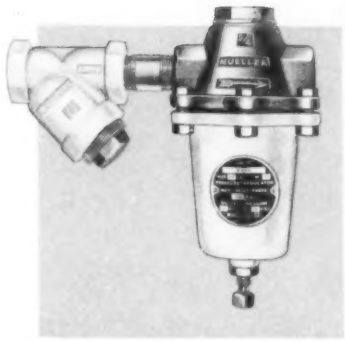
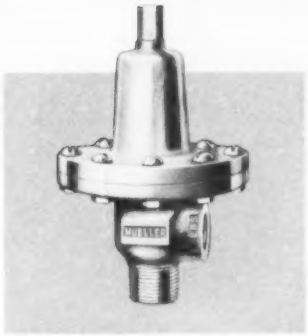


REGULATORS

Give pipe capacity flow with "minimum fall-off" of reduced pressure . . . accurately proportioned seat, diaphragm, and spring regulate flow without chattering or flow pulsation . . . outlet pressure adjustment from 5 p.s.i. to 125 p.s.i. . . . for water service.

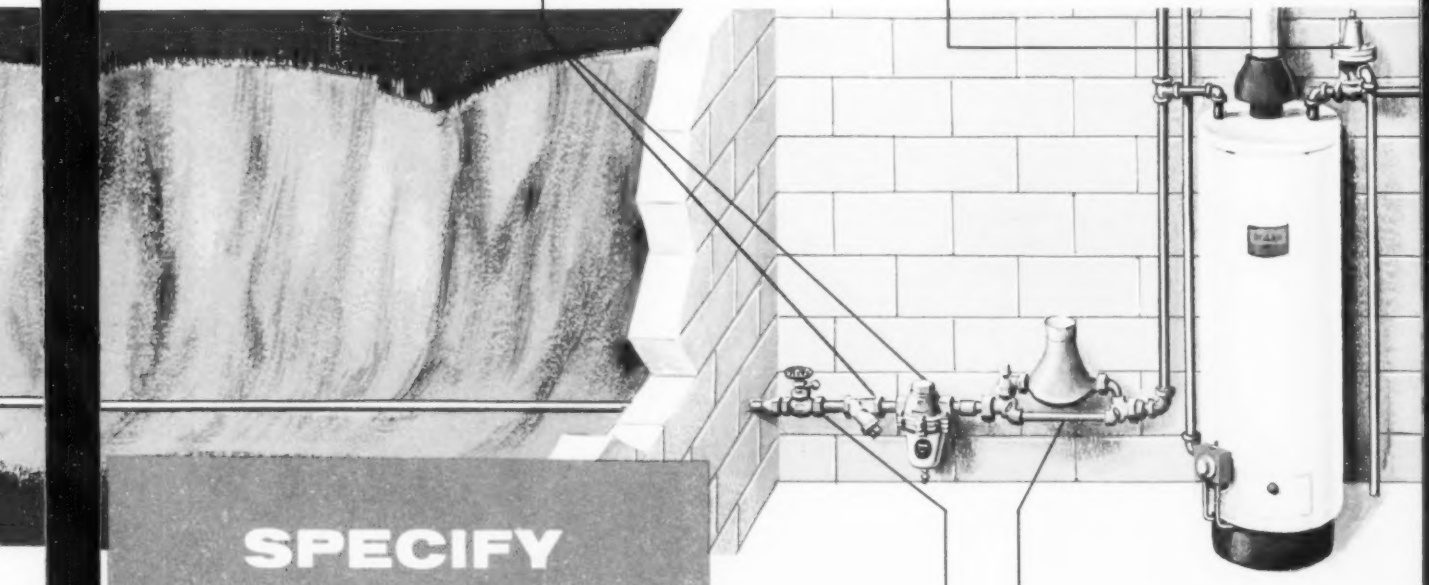
STRAINERS

For water service . . . galvanized iron or bronze sediment bowl type with clean-out plug gives long life . . . Y-type strainer with monel screen and clean-out plug—screen area four times pipe area . . . I.P. pipe connections . . . wide range of sizes.



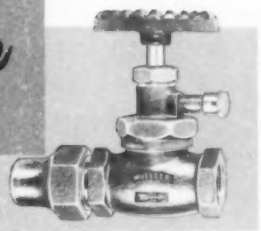
RELIEF VALVES

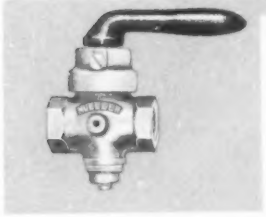
Monel or phosphor-bronze diaphragms and stainless steel seats assure positive operation at all times . . . fusible plugs for thermal relief . . . combined pressure and thermal relief models available . . . pressure relief to 160 p.s.i. . . . thermal relief to 212° F.



SPECIFY MUELLER

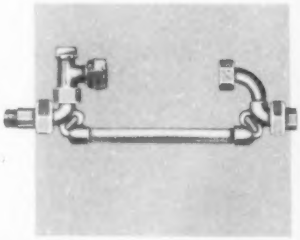
...all along the line





ROUGH PLUMBING

Deluxe quality ground key or compression stops with or without drains . . . Mueller red brass construction . . . popular lawn and sediment faucets with standard hose threads and handwheels . . . bronze gate valves . . . sizes and connections to meet every residential and industrial application.



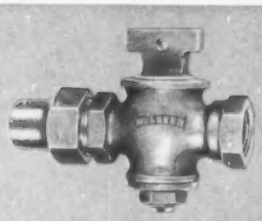
METER SETTING EQUIPMENT

Mueller engineered meter yokes provide tailor-made installations . . . reduce installation time and protect meters from piping stresses . . . copper yokes and relocaters with or without stops . . . iron meter yokes . . . angle or lock-wing meter stops, ground key construction . . . meter couplings and meter box covers to complete the installation.

other

MUELLER®

service products

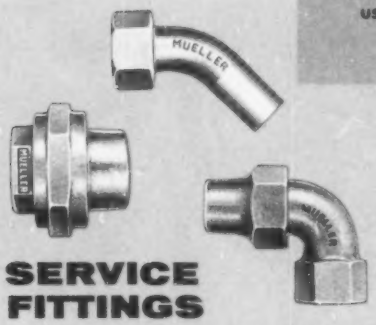


SOLID TEE HEAD CURB STOPS

Solid Tee Head curb stops feature a one-piece key and tee. The combined key and tee provide a much stronger unit. The key and body, cast from waterworks bronze, are precision machined and lapped to assure pressure tightness. The regular or Minneapolis patterns are available in sizes ½" to 2" with or without checks and drains.

GOOSENECKS

Three types of connections are available—wiped joint, lead flange, and solder joint. The wiped joint and lead flange goosenecks are available with 2 to 8 branch connections. Corporation stops can be furnished with each gooseneck. Extra Strong or Double Extra Strong lead pipe is used exclusively.



SERVICE FITTINGS

Mueller Co. manufactures a complete array of service fittings. Elbows, tees, corporation stop couplings, branch connections, unions, lead flange fittings and solder nipples and plugs form a complete selection. Sizes are available for every application.

COMPRESSION STOPS

High quality red brass construction. Wheel handles and optional drains make them quite popular for use as meter stops and customer cut-offs just inside the house. Iron or copper pipe connections, sizes ⅜" to 1".

For additional information and service, consult your Mueller Representative or write direct.

MUELLER CO. Since 1857 SERVING the Water and Gas Industries QUALITY

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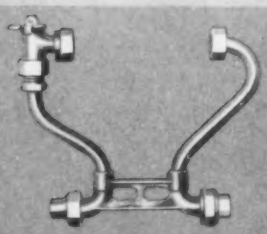


COPPER METER YOKES

Especially designed to overcome piping stresses and prevent subsequent damage to the meter. Flexible copper yokes give faster, easier instaliations even when the service pipe is out of line. Copper yokes are available with or without angle meter stops for ⅝", ⅝" x ¾", ¾" and 1" meters.

Are you risking lives... and your reputation on "SHORT LIFE" PAVEMENT MARKINGS?

These pavement markings, now barely visible, were laid with ordinary traffic paint. They just couldn't stand the gaff . . . and quickly wore away. These worn out markings create danger for drivers and pedestrians . . . and do nothing to enhance the reputation of the traffic engineer.

How do you come out of this situation, smelling like the proverbial rose? Turn to Catatherm Reflective Plastic Striping. Catatherm is composed of specially formulated plastic resins, pigment and over 55% reflective traffic beads . . . is hot extruded directly and securely onto any pavement . . . is available in white and yellow.

If you're interested in doing a striping job that defies criticism . . . gains brightness with wear . . . one that will outlast good quality paint stripes from 9 to 26 times . . . write for complete information, today.

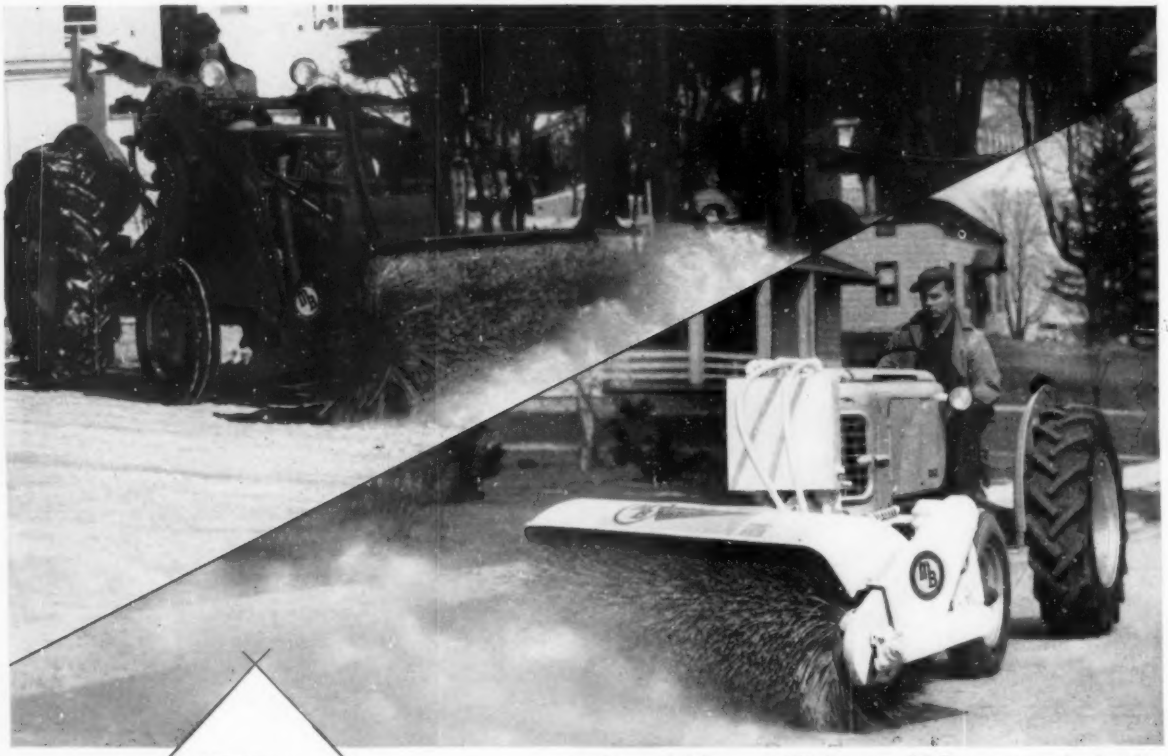
Cataphote
CORPORATION

TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

Manufacturers of: CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS

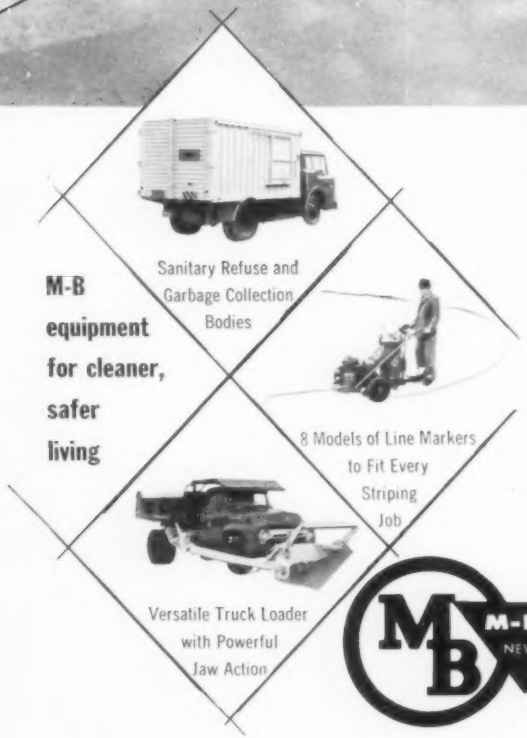
multiply tractor use ...on any job ...in any season

Whether it's June or January, M-B sweepers help you get more value from your tractors. No matter what the season, there's always a job best handled by a tractor sweeper. Here are only a few examples from dozens of typical applications: sweeping sidewalks, streets and playgrounds of dirt and debris; clearing snow up to 6″ in depth from thoroughfares, parking lots, etc. . . . also a handy clean-up unit for following snow plows; sweeping grass in parks and on boulevards; keeping runways, parking lots and driveways clear at airports; sweeping street and highway surfaces clean before and after black-topping . . . there's no limit to the



variety of jobs. ▪ With new, M-B two-way hydraulic sweepers, you finish sweeping jobs even faster and more efficiently than before. Your operator has complete control of the two-way, 30° sweeper angle, brush lift and brush rotation while working. "Dead runs" are reduced and the operator has unmatched maneuverability in the tight spots. ▪ M-B hydraulic sweepers are easily mounted on most popular make tractors and tractor-loaders . . . the sweeper head can be separately mounted or removed in minutes. Brooms are available in 32″ diameter, 60″ and 72″ lengths . . . may be turned end-for-end to maintain even wear. M-B mechanical drive tractor mounted sweepers and heavy duty, pull type sweepers have the same high standards of construction and performance. ▪ Your tractor dealer has complete information on the M-B sweeper best suited to your requirements. Call him now for the full story.

M-B Corporation, New Holstein, Wis.


M-B equipment for cleaner, safer living
Sanitary Refuse and Garbage Collection Bodies
8 Models of Line Markers to Fit Every Striping Job
Versatile Truck Loader with Powerful Jaw Action

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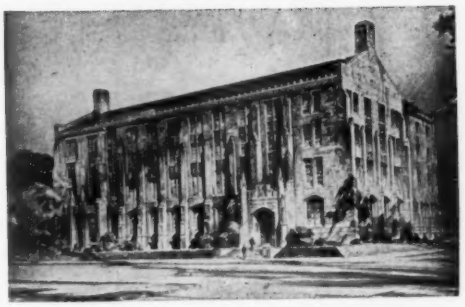
NEW HOLSTEIN, WIS.

MANUFACTURERS OF QUALITY MUNICIPAL AND CONSTRUCTION EQUIPMENT since 1907

APWA News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Michigan Public Works Conference Features Action-Packed Program

Lansing, Mich.—Approximately one hundred members and guests attended the 1958 Michigan Public Works Conference at the Civic Center in Lansing. The program included a lively discussion of several timely topics, a reception sponsored by the Michigan Equipment Dealers Association, Michigan Concrete Pipe Association and the Portland Cement Association, and a dinner meeting which featured a talk, that kept the audience laughing from start to finish, by Charles Allen Smith, Professor of English of Western Michigan University of Kalamazoo.

Other highlights of the dinner meeting included greetings from Mayor Ralph Crego of Lansing; the presentation of certificates to past presidents of the Michigan Chapter by Robert Bugher, Executive Director of the APWA, and the presentation of a resolution adopted by the Association's Board of Directors to Glenn C. Richards, Commissioner of Public Works of Detroit, which expressed its appreciation for the outstanding contribution he made in representing the APWA on the National Committee on Urban Transportation of which he served as Chairman from the time it was organized in 1955 until January 1, 1958. The resolution was presented to Mr. Richards by Leo Flotron, Chief Highway Engineer of Dayton, Ohio, who is a member of the Association's Board of Directors.

Mr. Richards

City Engineer Robert M. Bruce, of East Lansing, presided at the opening session which included a panel discussion on "Public Improvements In New Subdivisions" by Ralph E. Spear, Jr., Staff Engineer, Michigan Municipal League; Maurice Rapkin, Site Engineer, Federal Housing Administration, Detroit; R. A. Trebilcock, City Engineer, Coldwater; and Fred R. Storrer, Consulting Engineer, Dearborn. At the afternoon session, Roy F. Goodspeed, Director of Public Works of Ferndale, presided over a very interesting discussion covering "Standardization of Public Works Specifications" and "Prequalification of Bidders." Participating in this portion of the program were Lawrence Crandall, Assistant Director of Public Works of Battle Creek; Harold K. Schone, Director of Public Works of Oakland County; George H. Sandenburgh, Supt. of Public Works of Ann Arbor; and C. J. "Irish" Carroll, Executive Secretary of the Michigan Road Builders Association.

The final topic on the technical portion of the program was "Public Works Maintenance." Louis H. Moehr, City Engineer of Wyandotte, was moderator of this session which included talks by Hugh A. Benner, Director of Public Works of Saginaw; Collins Thornton, Director of Public Service of Lansing, and Louis Brinkman, Supt. of Street Construction and Maintenance for the City of Detroit.

Wives accompanying the delegates were treated to a special tour of the State Capitol Building; a luncheon, and a demonstration of flower arrangements which was planned by a Ladies Committee headed by Mrs. Collins Thornton of Lansing.

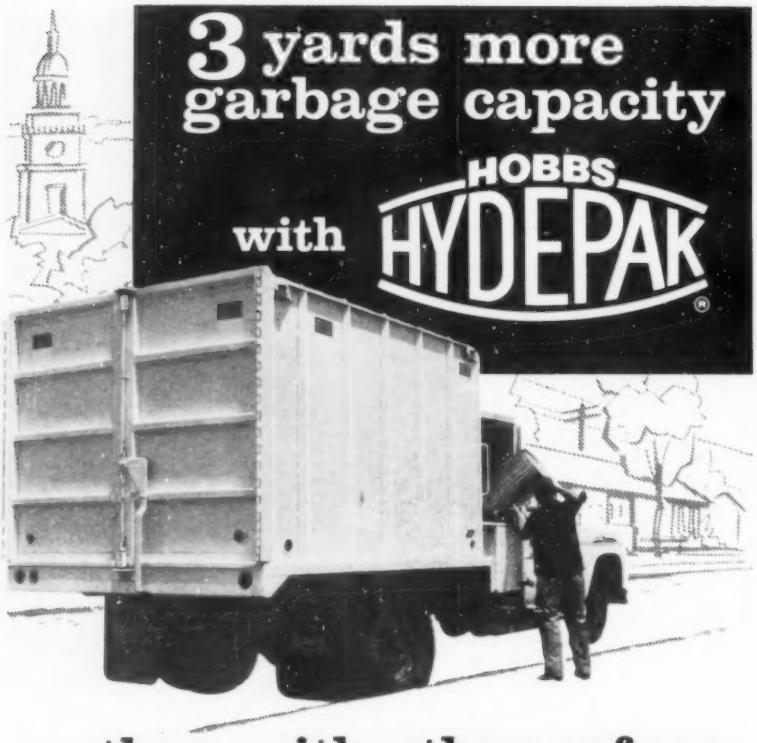
Tennessee Chapter Holds Meeting With State Municipal League

Nashville, Tenn.—The Tennessee Chapter of the APWA held its Spring meeting in Nashville in conjunction with the 19th Annual Convention of the Tennessee Municipal League. Chapter President Karl Stallings, Director of Public Works of Nashville, presided at the opening luncheon.

Four topics were discussed at the meeting: Charles K. Marsh, Assistant City Manager, Kingsport, gave a talk on "Planning Public Works"; Robert A. Lovelace, Consultant, Municipal Technical Advisory Service of the University of Tennessee, spoke on "Personnel Management"; Marble Hensley, Director of Traffic and Planning for Chattanooga, discussed the subject of "Street Traffic Control" and Edward J. Shea, Alumni Secretary of Vanderbilt University, gave an interesting talk on "Public Relations."

Charles K. Marsh was elected President of the Chapter to succeed Karl Stallings. Bruce Bynum, Commissioner of Public Works of Jackson, was elected Vice President, and Murphy Snoderly, Public Works

OFFICERS: Sol Ellenson, Newport News, Va., *President;* Wm. D. Hurst, Winnipeg, Manitoba, Canada, *Vice President.* REGIONAL DIRECTORS: (term ending 1958) Jean L. Vincenz, San Diego, Calif.; Leo Flotron, Dayton, Ohio; Roy W. McLeese, Salt Lake City, Utah; (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas. *Immediate Past President,* Robert Anderson, Winnetka, Ill. Robert D. Bugher, *Executive Director*



. . . than with other refuse packers of comparable cost!

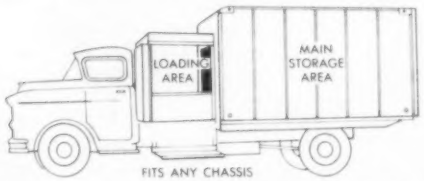
Put your garbage collection operation on a simplified, money-saving basis with Hobbs Hydepak, the refuse packer which gives you *three yards more capacity*—yet less body weight—than similar bodies of comparable cost!

LOOK AT THIS COMPARISON:*		Hobbs Hydepak Model 1619	Body G	Body P
	Body Volume, cu. yds.	**16.2**	**12.7**	**12.9**
	Empty Weight, lbs. (including weight of trucks)	**12,180**	**13,740**	**12,280**

*Measurements by an independent testing laboratory for a major Southwestern city.

Volume, as measured above, is body space into which refuse can be *completely compressed* and does not include the three-yard loading compartment at the front (see drawing). When you buy a refuse collection body of a given capacity make sure how much of the total volume is really *compressible* volume, and how much is in the loading hopper, where only partial compression is possible.
There's a big difference!

Available in 13, 16, 20 and 24 cu. yd. capacities (not including 3-yard loading compartment).



HYDEPAK is a division of HOBBS TRAILERS leading manufacturer of truck-trailers and bodies

For full information, write to Hydepak Div., Hobbs Trailers, 609 No. Main, Fort Worth

FOR MORE CAPACITY PER TRIP, GET HOBBS HYDEPAK

Consultant for the Municipal Technical Advisory Service of the University of Tennessee at Knoxville, was re-elected Secretary-Treasurer.

Arizona Members Hold Border-Line Meeting

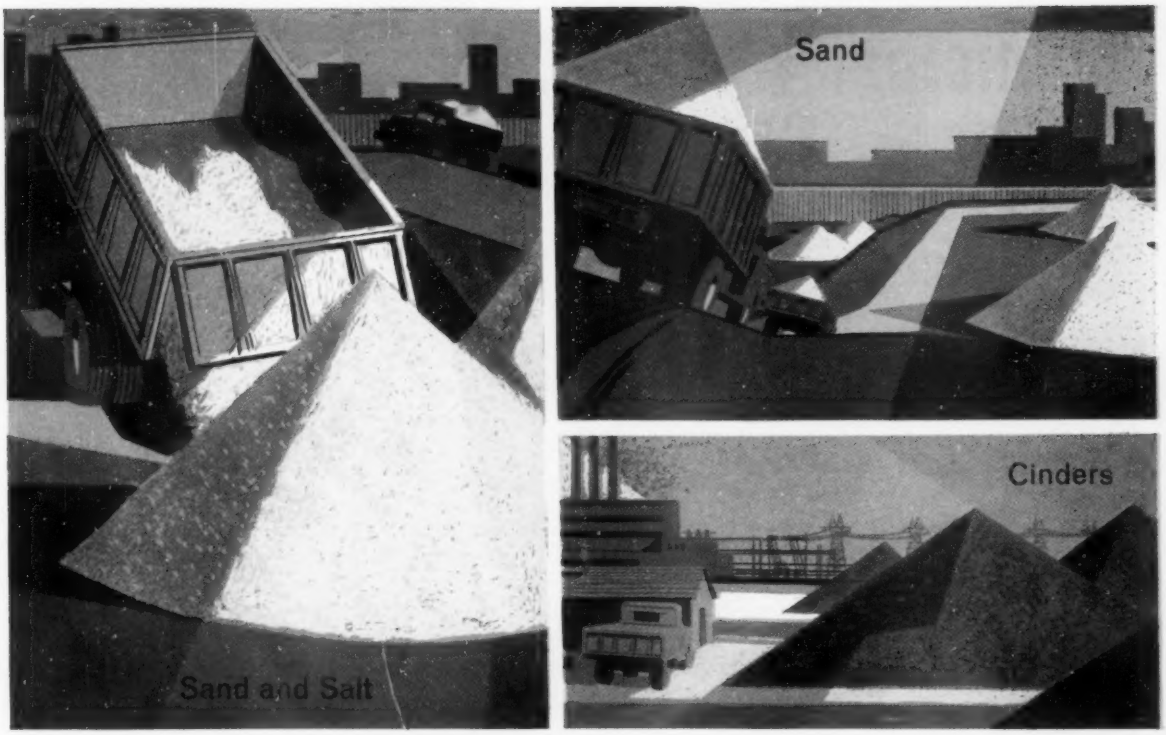
Nogales, Ariz.—Public works officials throughout the State of Arizona convened at the border-line city of Nogales for the annual meeting of the Arizona Chapter of the APWA. The meeting was held concurrently with the 1958 Convention of the League of Arizona Cities and Towns.

Chapter President John H. Brown, Assistant City Engineer of Tucson, presided at the opening session and at the luncheon meeting which was held in Old Mexico. The technique of soil stabilization was discussed and illustrated by Fred Glendening, District Engineer of the Portland Cement Association, at the Thursday morning session. The program also included a talk on "Trees" by Gene Reid, Superintendent of the Tucson Park Department, and an interesting panel discussion on refuse collection and disposal. Sam Tucker, City Engineer of Phoenix, presided at this session which included talks by W. C. Estes, Manager, Garbage Disposal Service, Phoenix; L. O. Henry, Engineer, Pima County Sanitary District No. 1, Tucson; E. E. Nelson, Jr., Street Maintenance Division, Phoenix; and Tom Price of the Sanitation Division of Tucson's Department of Public Works. The concluding session consisted of a panel discussion of problems relating to all phases of public works which was moderated by Arnold Johnson, Assistant City Engineer of Phoenix.

Annual Meeting of Alabama Chapter Held in Birmingham

Birmingham, Ala.—Public works officials of Alabama gathered at the Tutwiler Hotel in Birmingham on May 8 and 9 for the annual meeting of the Alabama Chapter of the American Public Works Association. The dinner meeting featured a talk by Dr. J. L. Brakefield, Director of Public Relations of the Liberty National Life Insurance Company.

Chapter President Neal McRae, Superintendent of Streets of Birmingham, presided at the two-day meeting which included a talk by Col. U. N. James, Coordinator of Civil Defense for Jefferson County, and another by J. T. Waggoner, Commissioner of Public Improvements for the City of Birmingham. The widely publicized film, "The



To rid streets of ice and snow . . .

Straight Morton Rock Salt does the job abrasives and mixes can't do

City officials have found that straight Morton Rock Salt is 8 times better than abrasives . . . that one man and one truckload of Morton Rock Salt does a better job of ice and snow removal than 8 men and 8 truckloads of abrasives. Straight Morton Rock Salt (rock salt not mixed with sand, cinders, or other abrasives) leaves no messy residue on streets, in gutters and sewers . . . won't blow away or leave a rutted, dirty pavement . . . needs no flushing after a thaw.

Non-toxic, easy to use, Morton Rock Salt is inexpensive. (It generally costs far less than calcium chloride.)

It pays to order Morton Rock Salt early

Smart purchasing agents, highway officials and city managers know it pays to be prepared before unexpected storms ice streets and highways. They know they eliminate confusion, extra work and accidents by stockpiling Morton Rock Salt early for winter ice and snow removal.

Send for more information today!

☐ *Please send me your free book on ice and snow removal.*

☐ *I would like a Morton representative to advise me on how best to stockpile Morton Rock Salt for my town.*

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INDUSTRIAL DIVISION
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Chicago 6, Illinois

Municipal Water Filter Installation cost can be cut 1/3 to 2/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL RJ because:—

1. The original cost of a diatomite plant for public supply is ⅓ to ⅔ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces bacteria and removes organic matter to an exceptionally high degree with attendant low chlorination requirement. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.
5. Sparkler Filters can be used with pretreated water when such treatment is necessary or desirable.

Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

Less than 0.2% of the harvested filtered water is required to sluice and clean the Model RJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, highly skilled specialized personnel is not required to insure efficient performance.

Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

SPARKLER FILTERS

SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

Road Ahead," concerning the stepped-up Federal-Aid Highway Program, was presented by the Thompson Tractor Company of Birmingham. N. L. McCrory, Supt. of Public Works of Opelika, showed a very interesting film about the fine public relations program that has been developed in that city.

W. W. Hill, Supt. of Public Works of Auburn, was elected President of the Chapter at its annual business meeting. Commissioner J. T. Waggoner was named Vice President and Rex McGinnis, Supt. of Paved Streets for the City of Birmingham, was elected Secretary-Treasurer. Retiring President Neal McRae continues to serve as a member of the Executive Committee together with Mayor Felix E. Erwin of Tarrant; Robert V. Hawkins, City Engineer, Tuscaloosa; Mayor V. H. Albright, Haleyville; and Oliver Wright, Supt. of Maintenance of Montgomery.

The ladies in attendance enjoyed a tour of some of Birmingham's many attractions on Thursday morning and then joined their husbands for the chapter's annual equipment show and barbecue.

Washington State Chapter Meets at Spokane

Spokane, Wash.—A diversified program featuring the application of recent technological developments in public works as well as attention on continuing operational problems was presented to the sixty-one members and guests attending a two-day meeting of the Washington State Chapter at Spokane, Washington.

The program presentations included: "Electronic Computers in Municipal Engineering," by Jean L. DeSpain, City Engineer, Olympia; "Photogrammetric Engineering Services for City and County Governments," by Carl M. Berry, Consulting Engineer, Seattle; "A Year of Natural Gas In the Northwest," by Wilson Gaw, Vice-President for Public Relations, National Gas Co., Seattle; "Considerations for Scientific Education in Washington Public Schools," by John L. Fea, Director of Instructional Materials, Office of the Washington State Superintendent of Public Instruction, Olympia; "Contractors' Viewpoint on Public Works Construction," by Ralph W. Finke, Construction Engineer, MacRae Bros., Seattle; and "Co-Operation in Freeway Construction," by R. H. Kenyon, Chief Engineer, Plans and Contracts, Washington State Highway Department. In a panel discussion on mu-

Hydro E-Z Packs cost less to buy, operate, maintain...

Compact Shape uses space to best advantage, permits mounting on smaller trucks, cuts initial cost to a minimum.

Faster Collection and fewer trips to the dump cut man-hours, reduce truck operating costs because load is packed en route.

Simplified Design and accessibility mean lower maintenance costs.

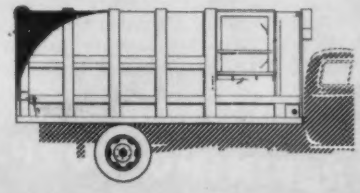
Less Maintenance means less strain on parts because hydraulics do not have to operate continuously resulting in less servicing of truck engine and transmission.

LOOK AT THESE FEATURES:

- Greater Capacity
- Large Openings on both sides and top
- Powerful Compaction
- No-Drip Body
- Simplified Hydraulic System
- Fully Enclosed Load

HYDRO E-Z PACK—THE MODERN DISPOSAL METHOD—*Write Today for Full Details*

Hydro E-Z Pack easily handles bulky objects like this washing machine—compaction method applies up to 76,800 lbs. at 1350 psi of crushing force.



Darkened area shows space increase over conventional models. Compact design permits mounting on shorter body.

Release tailgate, engage the packer—load dumps quickly, completely, safely.

HYDRO E-Z PACK

HYDRO E-Z PACK DIVISION—**HERCULES GALION PRODUCTS, INC.**, GALION, OHIO EZ-458

nicipal construction by contract the following topics were presented: "Specifications," by Philip G. Holgren, City Engineer, Spokane; "Design Based Upon Operations," by Sam C. Guess, Exec. Secy., Spokane Chapter, Associated General Contractors, and "Inspection and Records," by Carl Arness, City Engineer, Pullman.

President Chester E. Murray presided at the business meeting which included committee reports and the annual election of officers. The membership committee reported an increase in chapter membership of almost 75 percent since 1956. The report of a survey of the committee on Public Works Recruitment indicated strong approval for APWA to initiate a program devoted to encouraging graduates to enter the public works field. The committee on Storm Drain Financing reported on inequities of financing and the difficulties in finding an equitable assessment method.

At the election which climaxed the business session, Roy Morse, City Engineer, Seattle, was elected President; Chester L. Waggener, Director of Public Works, Moses Lake, Vice-President; Earl Elton, City Engineer, Bremerton, Secretary-Treasurer; and Carl Arness, City Engineer, Pullman and L. R White, City Supervisor, Burlington, Directors.

ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
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PHELPS DODGE REFINING CORPORATION
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Flood Control Featured at New England Meeting

Auburn, Mass.—G. O. Evans, Area Engineer, Springfield Office, U. S. Corps of Engineers, discussed flood control projects at Hodges Village and at Buffumville at the June 25 luncheon meeting of the New England Chapter. Mr. Evans' talk was supplemented by motion pictures taken during the construction of the Hodges Village Dam and a guided tour of the projects.

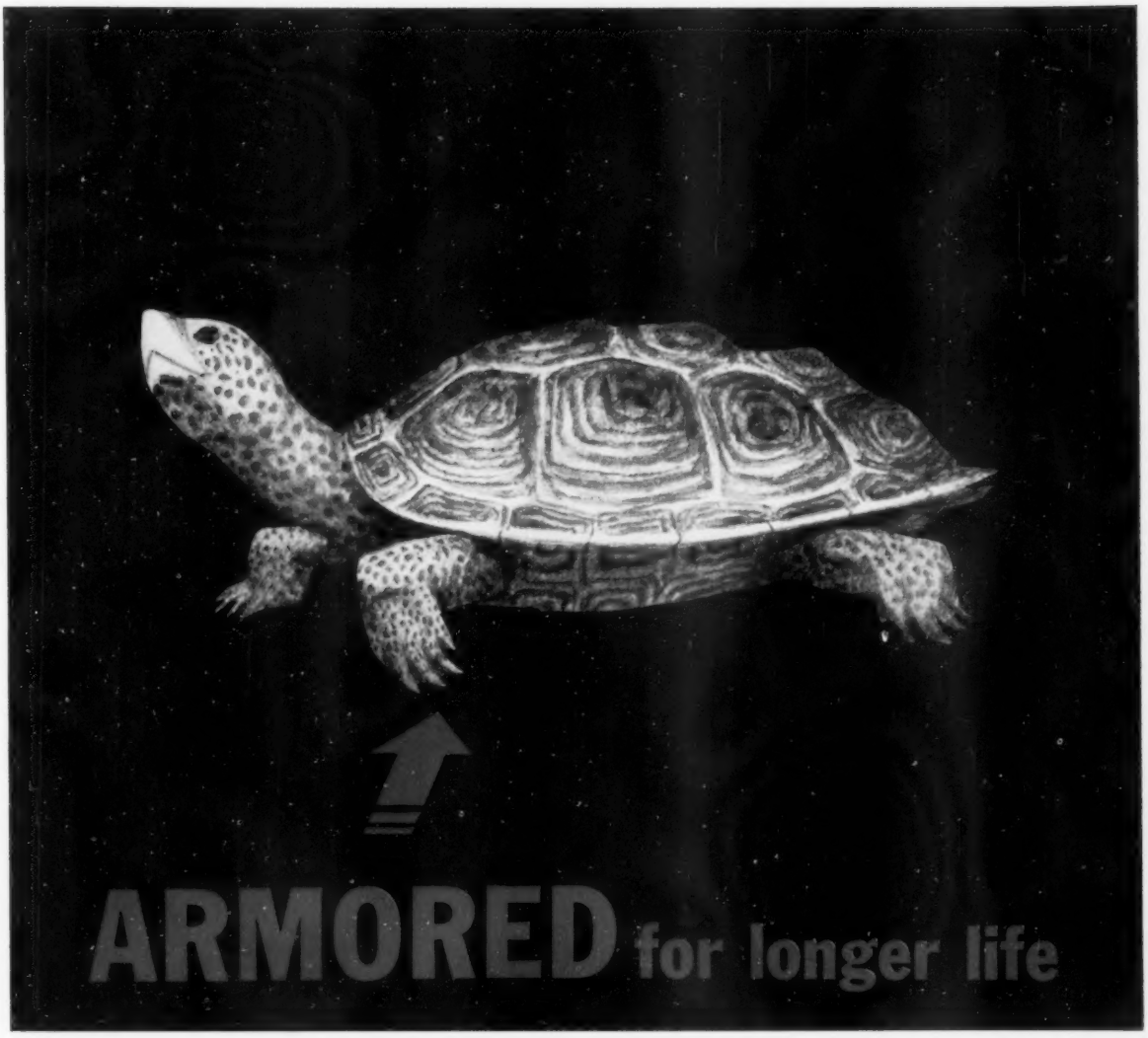
T. J. "Tim" O'Leary, Boston, Mass., was elected President for the year 1958-1959. Robert B. Strong, Providence, R. I., was elected Vice-President; Bradford Clark, Providence, R. I., Secretary-Treasurer; Reynolds Northup, Bristol, R. I., Director for one year; and Lyman Lovell, Hartford, Conn., Director for two years.

Utah Group Inspects Water Filtration Plant

Bountiful, Utah—Carl E. Painter, President of the Utah Chapter, reports that a meeting on June 20 featured a tour of Plant Number 4 of the Weber Water Conservancy District. The plant is rated at 10 Sec. Ft. but has been designed so that it can be expanded to a capacity of 40 Sec. Ft. This is the first purification plant built in the area using Anthrafilt as a filter media.

Kentucky Meeting Features Session on Roads and Streets

Louisville, Ky.—Robert Weikel, Jr., Superintendent of Sanitation, Owensboro, presided at the opening session of the June 27 meeting of the Kentucky Chapter held at the new Exposition Center of the Kentucky Fairgrounds, Louisville. Some 40 municipal officials participated in the all day session which co-featured a panel on roads and streets moderated by F. K. Kyle, City Manager of Ashland and a paper on refuse collection practices. J. C. Cobb, District Director, Bureau of Public Roads discussed Federal Planning and Construction and Robert Bagby, Kentucky Highway Department reviewed the state planning and construction program as it related to urban areas. The speakers emphasized the importance of local study and close coordination with the BPR. Mr. Cobb indicated that Federal Highway Administra-



PD-86

Simpson Overlaid Plywoods bring to signs the same protection that is afforded the tortoise by his shell. The finest sign material ever developed, Overlaid Plywood is as workable as ordinary plywood . . . gives better results than metal. Signs made with this material will not crack, chip nor shatter. They cannot be wrapped around their posts by vandals and bullet holes almost seem to seal themselves. Your signs will live *years* longer on Simpson Overlaid Plywood.

HIGH DENSITY: Is available in black for direct application of reflective material (needs no painting) or smooth, natural finish, ready for painting.

MEDIUM DENSITY: Is especially fine for painting, having been developed for this purpose. No finer surface for painted bulletins, billboards and cut out "spectaculars."

◀ *State after state is standardizing on Overlaid Plywood signs.*

RELY ON Simpson® PLYWOOD

For information and samples, write to:

Simpson Logging Company, Plywood & Door Products, 2301 N. Columbia Boulevard, Room 1102-H, Portland 17, Oregon: Regional Offices in New York, Cleveland, Minneapolis, Chicago, Denver, Memphis, Dallas, Los Angeles, Seattle, and Portland.

tor Tallamy is now considering the appointment of a Board of Urban Consultants of similar organization and purpose in the urban area as the county and state boards which are already in existence to advise on matters affecting their respective areas.

Earl Patton, City Engineer, Owensboro, discussed road maintenance and repair, stressing different methods may be applicable in each city. The need for good subdivision control including streets built to city specifications was emphasized.

General discussions of cleaning of streets and gutters and traffic control were led by Robert David, Superintendent of Public Works, Covington and Joseph Heindenreich, Traffic Engineer, Lexington. In the afternoon, a report on refuse collection practices was given by Leo Weaver, Director of Research, APWA, Chicago.

At the annual business session Russell Marshall, City Manager, Frankfort, was elected President for the year 1958-1959. Herman Regan, Lexington, was elected Vice-President; Thomas Williams, Newport, Secretary-Treasurer; and J. H. Polk, Ashland, Director for two years.

Afternoon inspection trips were led by John Leake, Director of Sanitation. These included observation of Louisville's new 1000 ton refuse incinerator, the new sludge drying plant located adjacent to the incinerator plant to permit utilization of waste heat and the new sewage disposal plant.

PLASTIC STRIPING FOR CROSSWALKS

LOS ANGELES is experimenting with plastic striping material containing glass reflector beads for crosswalks to provide safety-marked lanes for pedestrians. Under the direction of S. S. Taylor, general manager, Department of Traffic, and Peck Shell, engineer for the Cataphote Corporation, 10,000 pounds of plastic striping have been applied to 25 crosswalks, principally in the San Fernando Valley. A special applicator on wheels is used; application is at 400° and the material dries in five minutes, forming an elliptical crown 3/16" high.

The Department of Traffic is constantly seeking more permanent types of coatings to improve the street marking program. The painting crews cannot service every intersection more than once every three to four years on the average as there are more than 17,000 crosswalks to mark and maintain.

The hot plastic has been under test for more than three years. It is said to last long and to combine economy with a greater safety factor for motorists and pedestrians. It is vivid in the rain, drains well and is very effective.

snow plows

select and sell from a complete line of . . .

"V" PLOWS	from 8' to 9½' swath - nose heights 30" to 48"
WINGS	10' to 12' - partial or complete hydraulic control
TAPER PLOWS	9' to 12' length of cutting edge - full range of heights - reversible and adjustable or one-way
STRAIGHT PLOWS	reversible - 9' to 12' length - heights from 29" to 42"
COMBINATION PLOWS	hydraulic control in cab converts right hand taper to "V" and to left taper while in motion

plus custom designs and sizes

for additional information write
THE GLEDHILL ROAD MACHINERY CO.
Galion, Ohio

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IMCO
Floor System for All Types of Trickling Filters:

1—**It simplifies construction**—The units are self-spacing; they are easily set; they have high strength, thus permitting mechanical placing of filter stone . . .

2—**It assures effective aeration**—The grill blocks afford maximum apertures, with 40% of the filter area open to ventilation . . .

3—**It provides excellent drainage**— The channel blocks are smooth and unobstructed and flush jointed . . .

4—**It gives flexibility of design**— Filter blocks are supplied in shapes and fractional sizes to fit all forms of filters without the necessity of cutting blocks . . .

Our Engineering Department will gladly cooperate with Engineers in solving the design problems of all standard and high-rate trickling filters.

INDUSTRIAL MATERIALS CO.
Somerset St. and Trenton Ave.
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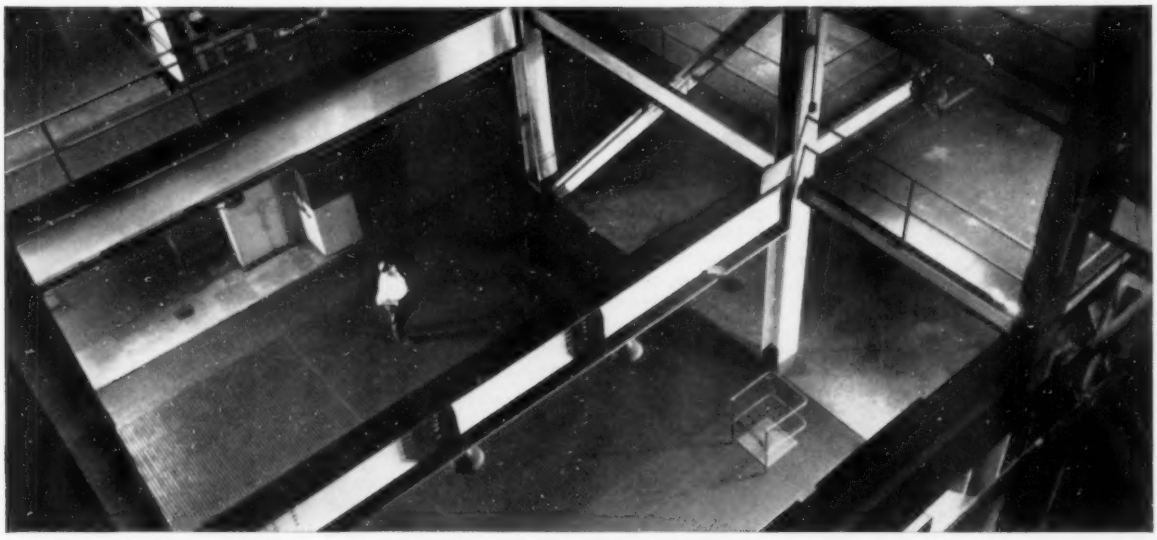
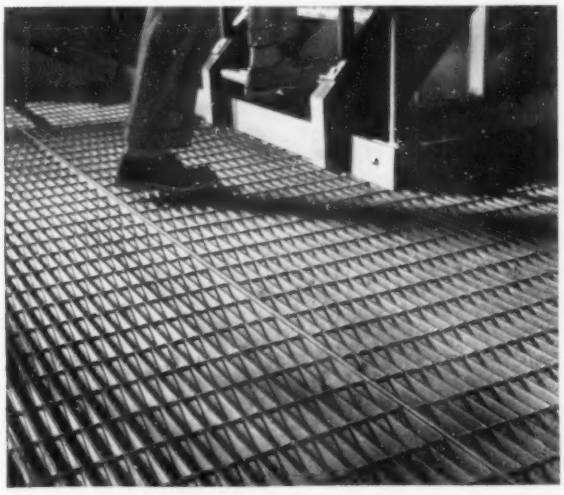
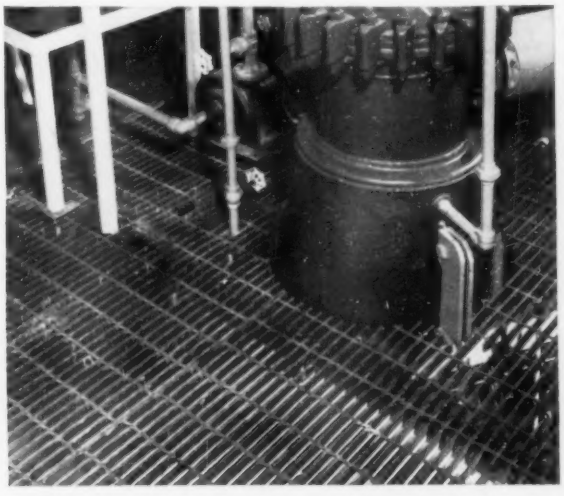
designed for flexibility...**Electroforged® for strength**
Blaw-Knox Grating fits modern plant needs



More floor space . . . Platforms, mezzanines and loading docks made of flexible Blaw-Knox Electroforged Steel Grating increase storage space, enlarge feeder areas. Easily installed, and easily adapted to changing layouts.



Safer walking . . . on *non-slip* floors, walkways and stairs, Blaw-Knox Electroforged Steel Grating provides rigid one-piece construction and features the twisted cross bar to make every step a safe step.



Fits anywhere . . . around pipes, beams and machinery to provide a neat, easy-to-maintain surface. There's nothing to wear, patch or catch dirt. And Blaw-Knox Grating admits more light and air for ideal working conditions.

Write for Bulletin 2527 and see how Blaw-Knox Grating can be custom fabricated to meet your plant improvement specifications.

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Equipment Division
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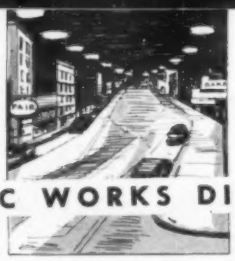


PUBLIC WORKS DIGESTS

Prepared by

FRANK FORCE

Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Special Delineators Help Reduce Accidents

Especially designed reflective delineators placed at hazardous locations on Virginia highways have reduced accidents, fatalities, injuries and property damage. The delineators now used at hazardous locations throughout the state are 48 ins. high and 6 ins. wide. They are made in the state's sign shop by applying a piece of silver reflective sheeting on aluminum and painting opaque 4-in. diagonal stripes on the face. The delineator is then mounted on a steel U post, and erected so that the bottom edge of the delineator is approximately 1 ft. above the crown of the pavement. The delineators, which cost about $15 each, are usually placed approximately 40 ft. apart on curves, starting well back on the curve approach, and about 100 ft. apart on straightaways, again well back from the hazard and leading up to it. They are usually erected on the shoulder about 4 ft. from the edge of the pavement. The accidents eliminated or reduced in severity were simply the result of 2 factors: Lack of adequate warning during the day; and reduced visibility at night. Solving these problems was the inexpensive key to much safer motoring on Virginia highways.

"Special Delineators Help Reduce Accidents." By J. P. Mills, Jr., Traffic and Planning Engineer, Virginia Dept. of Highways. *Better Roads*, June, 1958.

Subsurface Drainage For Streets and Airports

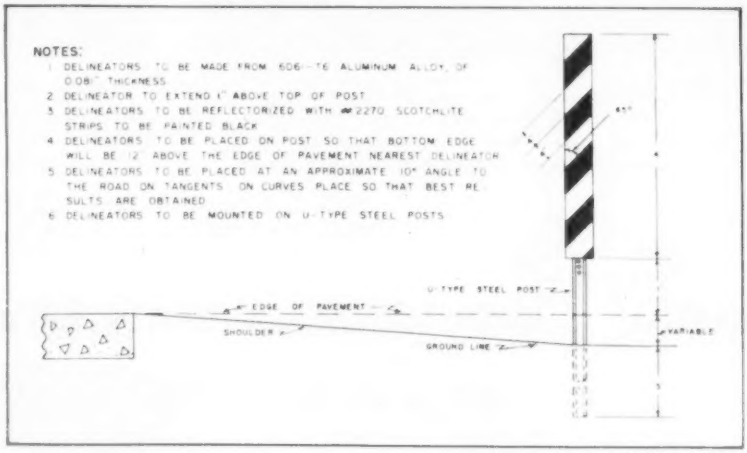
This is part 1 of a two-part series describing subsurface water and the basic elements required in planning a subsurface drainage system. Test borings made with soil augers for subdrains for an airport runway or a road are usually made along the proposed line of the final installation. For parking lots and athletic fields the borings are made in some regular predetermined pattern. Classification of soils samples can be done in a laboratory or by the men conducting the drainage survey if facilities are available. The mechanics of the sub-drain are expressed in an approximate relationship between the required capacity S, the depth of the drain h, the permeability of the soil k and c a coefficient. The formula is $S = \left(\frac{600 \times k \times h}{c^2}\right)^{2/3}$. There are 3 kinds of soil water: Gravitational; capillary; and hygroscopic. Laboratory apparatus is available for determining the water content of soil samples. When a soil sample passes from a plastic to a liquid state the water content of the sample is calculated by dividing the weight of water times 100 by the weight of oven dried soil. This then is known as the liquid limit of the soil.

"Subsurface Drainage." By J. R. Baittinger, P E, Civil Engineer, Scotch Plains, N. J. *The American City*, June, 1958.

Computer Applications For Small Consulting Firm

Brender and Brender, Inc., Consulting Engineers, have installed a Royal-Precision LGP-30 electronic computer that operates serially, or sequentially, with a program of instructions stored in its magnetic drum memory. Problems solved include traverse closures, computation of plats for subdivisions, determination of special assessment rates for public improvements, evaluation of water and gas distribution systems with the Hardy Cross analysis method and the computation of earthwork quantities. A ten to fifteen sided traverse can be processed on the LGP-30 in about fifteen minutes. In special assessment rates, original estimate computations can be performed, individual blocks kept track of, more information can be obtained than previously recorded, and be ready for the inevitable changes due to financial limitations and public hearings in less than 5 percent of the time previousiy required. The computer can handle the Hardy Cross analysis of a 21-loop, 54-pipe system in 1 hour of machine time. The program can handle up to approximately 1200 pipes, in almost any combination of loops. In earthwork computations there is a program to handle areas up to 4,000 feet wide, with unlimited length by processing the data in sections, with automatic carry over of accumulated totals.

"Computer Application For A Small Consulting Firm." By E. G. Brender, J. O. Frank & T. A. Weyand, Brender & Brender, Inc., Consulting Engineers, Wayne, Mich. PUBLIC WORKS, July, 1958.


NOTES:
1. DELINEATORS TO BE MADE FROM 6061-T6 ALUMINUM ALLOY, OF 0.081" THICKNESS.
2. DELINEATOR TO EXTEND 6" ABOVE TOP OF POST.
3. DELINEATORS TO BE REFLECTORIZED WITH #2270 SCOTCHLITE STRIPS TO BE PAINTED BLACK.
4. DELINEATORS TO BE PLACED ON POST SO THAT BOTTOM EDGE WILL BE 12" ABOVE THE EDGE OF PAVEMENT NEAREST DELINEATOR.
5. DELINEATORS TO BE PLACED AT AN APPROXIMATE 10° ANGLE TO THE ROAD ON TANGENTS. ON CURVES PLACE SO THAT BEST RESULTS ARE OBTAINED.
6. DELINEATORS TO BE MOUNTED ON U-TYPE STEEL POSTS.
45°
U-TYPE STEEL POST
EDGE OF PAVEMENT
SHOULDER
GROUND LINE
VARIABLE

Courtesy Better Roads

● **ROAD-EDGE delineators, used in Virginia, warn drivers and help guide traffic.**

How optically flat reflective sheeting keeps entire sign visible in any weather

With the ever-growing volume of traffic on city streets, it is increasingly important that signs function at their highest level at all times. This is especially true at night and in bad weather when the need for visibility is greatest.

Nighttime visibility of traffic signs through reflectivity has been an accepted fact for quite some time. But weather remains an enemy of most traffic signs . . . even reflective ones. That conditions of rain, snow, fog and the like curtail visibility is no secret. The "fair weather" sign, even under such conditions as a heavy dew, loses as much as 95% of its reflective quality.

Optically flat "Scotchlite" Reflective Sheeting, however, stands out in any weather. This is the sign material whose reflective elements are completely protected by a durable coating that not only guards the sign surface, but minimizes the distortion effects of weather.

No blackout in water

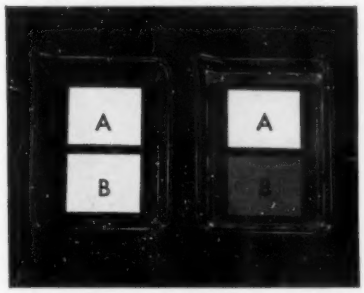


Fig. 1. The pan on the left holds two reflective samples. "A" is optically flat "Scotchlite" Sheeting; "B" is an exposed lens material. When dry, both reflect. In the pan on the right, one inch of water covers both samples. While "Scotchlite" Sheeting loses little of its designed reflectivity, sample "B," with its optical characteristics changed, "blacks out."

"Scotchlite" Reflective Sheeting, as you may know, is a reflex-reflector. It directs collected light from an approaching auto headlight right back to its source. An entire sign of this material reflects the full message of that sign—the true shape, color and legend. Because of the optically flat surface of the sign, its designed reflective characteristics are retained with a minimum loss of efficiency and performance in a heavy rainfall. Motorists can still see the entire sign clearly.

Where reflective elements are exposed, however, water fills in and alters the optical focus, causing a severe loss in reflection. The photo in Fig. 1 demonstrates this point.

Shown are two pieces of reflective material. That labelled "A" is optically flat "Scotchlite" Sheeting. "B" is exposed lens sign material. In the first picture, both are dry, both reflective. In the second, both have been placed *under water*. You can see how the sample of "Scotchlite" Sheeting continues to reflect to a high degree while the other, sample "B," has blacked out. Here is positive proof that "Scotchlite" Sheeting succeeds in communicating when exposed lens systems fail.

* * *

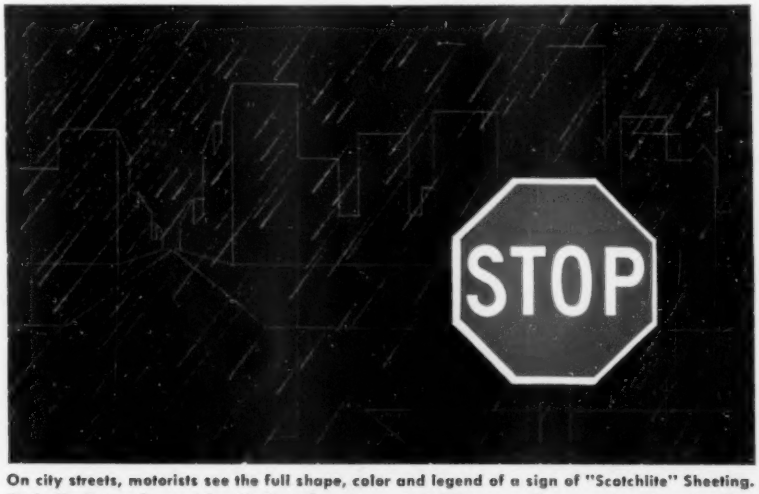
All-weather performance

Because of its high brightness and optically flat construction, a sign of "Scotchlite" Reflective Sheeting gives the best possible performance in rain, snow, dew, etc. It is the best answer man has yet devised against the enemy—weather.

Most effective sign material

Performance in any weather, of course, is just one measurement of an effective traffic sign. There are others that you may be interested in even more. For instance, angular performance for full-range brightness, ease of fabrication and maintenance, durability under city traffic conditions, economy. The most effective sign material for you is the material that offers the best performance and durability characteristics at the lowest over-all dollar cost. Only precision-made "Scotchlite" Reflective Sheeting meets these requirements so well.

Your 3M Representative will be happy to demonstrate any or all of these points to you. See him soon.



On city streets, motorists see the full shape, color and legend of a sign of "Scotchlite" Sheeting. Optically flat surface, with reflective elements protected from weather, remains distortion-free even during heavy rain. Sign won't "black out." Long and short range brightness stays high.

Or for more information on effective, durable all-weather signs of "Scotchlite" Sheeting, write: 3M Company, Dept. QV-88, St. Paul 6, Minnesota.

WIDE ANGLE FLAT-TOP®

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SCOTCHLITE

BRAND

REFLECTIVE SHEETING

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The term "Scotchlite" is a registered trademark of Minnesota Mining & Mfg. Co., St. Paul 6, Minn. General Export: 99 Park Ave., New York 16, N. Y. In Canada: P. O. Box 757, London, Ontario.

MINNESOTA MINING AND MANUFACTURING COMPANY—where RESEARCH is the key to tomorrow

Methods For Determining Capacity of Rural Roads in Mountainous Terrain

The development of traffic capacity information needed for the design of roads in rough or mountainous terrain has required the combined results of a number of independent yet related investigations. These investigations include studies of commercial vehicle weights and performance characteristics, driver passing practices, and the many types of studies normally associated with a capacity analysis such as frequency distributions of speeds and headways under different traffic volume and roadway conditions. This article is a combined effort of several agencies to develop practical procedures for the application of the results of such studies to a determination of highway needs in mountainous terrain. The procedures provide a significant advance in analytical procedures for determining improvements in traffic-operating conditions through better alinement, reduction in gradient, and the use of truck climbing lanes on the uphill side of steep grades.

"New Methods For Determining Capacity of Rural Roads in Mountainous Terrain." By O. K. Normann, Chief, Traffic Operations Branch, Bureau of Public Roads. James O. Granum, Automotive Safety Foundation, and Harry C. Schwender, West Virginia State Road Commission. *Public Roads*, June, 1958.

Economical Production of Concrete

Essential characteristics of finished concrete may be stated as follows: 1) Adequate strength; 2) durability; 3) watertightness or impermeability; 4) suitable surface quality—smoothness, texture and riding quality; and 5) capability of economical production. In order to have acceptable quality control of the concrete the following basic requirements must be satisfied: 1) Proper proportions of materials; 2) uniformity of mixing; 3) elimination of segregation; and 4) proper compaction, finishing and curing. The principal operations affecting quality control of the concrete are: 1) Handling aggregates; 2) batching; 3) mixing; 4) transporting and placing; 5) compacting; and 6) finishing and curing. Quality control and economy in production are not inconsistent in concrete construction. By proper planning, training of personnel and supervision of the work good quality concrete can be assured without running up the costs.

"Economical Production of Concrete With Quality Control." By Ellis Danner, Professor of Highway Engineering, University of Illinois. *Modern Highways*, June, 1958.

Sealing Bituminous Concrete Pavements

The Iowa State Highway Commission placed asphalt cement seals on flexible pavements of eight inches or more in total thickness with either bituminous surface treatment or bituminous concrete mat as the existing surface. Liquid asphalt seals were placed on flexible pavements of less than eight inches total thickness with an existing bituminous surface treatment. State maintenance crews repaired broken and ravelled areas prior to the surfacing operations and patched pot holes, poor joints and settled areas with cold mix patch material. Also tight surface blading was done on areas showing irregularities or corrugations in the surface. Contracts were let to place the seals and the contractors used power driven rotary brooms to clean the wearing surface. Binder bitumen was not to be applied until the surface was free from moisture and the atmospheric

The New TENNANT *VACUUMIZED* SWEEPER

Now...a new way to sweep up ALL* the dirt

NO DUST! NO WATER!

You've never seen such clean sweeping as you'll get with the TENNANT Model 100 *Vacuumized* Sweeper. *It gets the dirt most sweepers miss!*

Powerful pickup. Cleaning a 7'4" path at speeds to 9 mph, this revolutionary new TENNANT Sweeper instantly picks up practically *all* the dirt. Virtually nothing escapes its powerful broom-and-vacuum system.

No dust, no water. Since its vacuum eliminates dust where the TENNANT Sweeper is at work, all need for water spray is eliminated.

Wide range of uses. Exclusive mechanical features assure wide-range usefulness in downtown areas, alleys, parking lots and many other areas where conventional sweepers are impractical.

For complete specifications and performance data, write G. H. Tennant Company, 735J North Lilac Drive, Minneapolis 22, Minnesota.

**Particles as fine as 5 microns (far smaller than the human eye can see) are caught by the huge 540 sq. ft. filter.*

Plowing an

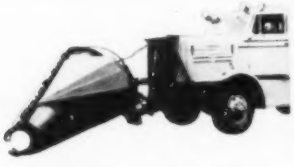
- AIRPORT
- PARKING LOT
- CITY STREET
- or EXPRESSWAY—

Think of

FRINK

ONE-WAY with Trip Blade—for high-speed throwing and spreading, but windrows neatly at city speed.

REVERSIBLE Trip Blade — all-purpose; plows left, right, bulldozes ahead; power reverse lever in cab.



ROLL-OVER with Taper Blade—for airports, expressways; rotates left or right in seconds; ends "deadheading."

The Plow Designed for the Power and Performance to Meet YOUR Snow Removal Needs

Whether snow removal problems in your area require a high-speed, heavy-duty V-type plow (**above**) or a lighter, maneuverable Reversible type, Frink has the plow specifically designed to do the job . . . faster, safer, at lower cost.

Frink, the pioneer in advanced snowplow design for 35 years, makes four basic types of plow, each with models to fit 1½ to 12 ton trucks . . . and most are interchangeable on same truck attachment. Get full details from your Frink distributor or write Frink for descriptive folders about any of these plows —

For Snow Plow Know-How
It pays to think of

FRINK SNO-PLOWS

CLAYTON, N. Y.
Frink Snow Plows of Canada, Ltd., Toronto, Ontario

temperatures were not lower than 50°F for liquid bitumens and 70°F for asphalt cements. The length of spread of binder was limited to provide complete coverage with aggregate within 30 mins. Transverse joints were made with the use of a 30-lb. roofing felt 36 ins. wide. Self-propelled pneumatic tired aggregate spreaders were used and compaction was done by three complete roller coverages with the first two coverages using self-propelled pneumatic tired rollers. The third coverage was made with a self-propelled smooth steel roller.

"Sealing Bituminous Concrete Pavements." By Van R. Snyder, Bituminous Engineer, Iowa State Highway Commission. PUBLIC WORKS, July, 1958.

Rubberized Asphalt Experiments in Wyoming and Montana

Evidence is accumulating which indicates that the rubberized asphalt cutbacks introduced several years ago by the Husky Oil Co. can be classified as a new material of construction. They meet the requirements of better seal coating agents that will hold chips firmly in place, protect the undersurface from water and weathering, and present a good overall appearance free from bleeding and slick surfaces. A rubber was selected which increased low temperature ductilities of the asphalt to the highest degree. It will have a ductility of 150 c.m. plus at 39.2°F. In the Montana test sections, RC-4D and emulsion were shot on the first section at 0.3 gal. psy with 26 to 28 lb. psy of chips. Later test sections were cut to 0.25 gal. It is noted in Wyoming that when RC-3 is used on a curved area twice as many chips are lost than when RC-3D is used. In Montana, the tenacity and ductility of the rubberized cutback showed that the chips are tied to the pavement by many independent cables of tough strands of rubberized asphalt.

"Rubberized Asphalt Experiments in Wyoming and Montana." By F. B. Odasz and R. V. Witter, Husky Oil Co., Cody, Wyoming. *Roads and Streets*, June, 1958.

Sign Preparation in Texas

Sign preparation in District 18, Texas Highway Dept., is done on an assembly line basis. Metal sign plates are placed in special racks and lowered by an electric hoist into a cleaning tank for 30 mins. The heating tank is gas fired and thermostatically controlled to keep the temperature at 200°F. After cleaning, the signs are placed in a rinsing vat of warm water and then placed on mobile racks to be taken to the paint-spray machine. The racks, loaded with around 600 sign blanks, are lined up near the loading end of the automatic paint-spray machine. About 600 signs are painted on one side in 4 hours, allowed to dry until the next morning, and then painted on the other side, which results in 4 days time to place 2 coats of paint on each side. It takes the electric-powered beading machine a day to place the beaded coat on the signs. This machine is attached to the paint-spray machine, which eliminates the necessity for loading and unloading. Both the silk screen and stencil methods are used for applying messages to sign blanks. Wooden signs are made in the carpenter shop and are built from ¾-in., marine-type plywood. The blanks are cut to shape, corners are rounded and sanded. They are given 2 brush coats of paint on each side and then taken to the paint-spray room for bead coat application by machine.

"Sign Preparation". By Frank W. Cawthon, District 18 Engineer. *Texas Highways*, May, 1958.

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ONLY LOADER with "Elbow-Action"

Here's a multi-purpose unit that can substantially *lower* the cost of such jobs as: Maintenance of streets, parks, etc.; Collection of trash, leaves and dumping of street sweepers; Handling of sand, crushed rock and numerous other loose materials. Use of a self-loader saves time, labor and equipment by permitting the truck driver to do light digging, grading, loading and hauling . . . without additional manpower or equipment. The LOADER is hydraulically operated, lifts ¾ yard of material per bucket, loads the average dump truck in about 4 minutes and can be used very profitably on most any 2, 2½ or 3 ton truck.

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The Loader can be equipped with a hydraulically operated claw which allows the operator to pick up about 25% more material per bucket. Through rugged strength and flexibility of "Elbow Action", loading can be easily accomplished from a standstill—with complete inversion and emptying of bucket, *without* spillage or cab protector.

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Maximum Safe Vehicle Speeds at Railroad Grade Crossings

A method has been developed by the Phoenix, Ariz., Div. of Traffic Engineering to determine the maximum safe vehicle speed at railroad grade crossings, dependent on the visibility at the crossing and the speed of the train. The basic theory involved uses physics formulas for speed and distance to compute vehicle speed with respect to train speed so there would not be a collision. The formulas are $S = Vt$, $S = V_{,,}t + {}^1/_2\ at^2$, and $V^2 + V_{,,}^2 + 2$ as; where S = distance in feet, V = velocity in fps, a = acceleration in fps squared and t = time in seconds. When a train and a vehicle approach a crossing there are 3 possibilities: 1) The vehicle stops for the train; 2) the vehicle accelerates and beats the train; and 3) there is a collision. By using the first 2 formulas and plotting the initial speed of the vehicle, $V_{,,}$ versus distance, S, of vehicle and train from crossing, and with t as parameter, a series of minimum speeds to cross safely are obtained. The third formula can be solved to obtain a series of minimum speeds to stop safely for different distances of a vehicle and train from a crossing. Where vision is good, there is no range of speeds that is a trap and accidents are entirely the result of carelessness. In order to provide marginal protection at vision-impaired crossings, flashing light signals are necessary.

"Maximum Safe Vehicle Speeds at Railroad Grade Crossings." By Arnold A. Johnson, Assistant City Traffic Engineer, Phoenix, Ariz. *Traffic Engineering*, June, 1958.

Other Articles

"Pavement **Markings Improve Traffic Flow.**" A total of 85 miles of center and lane lines have been painted with an additional 27 miles being painted this year in Springfield, Mo. By H. M. DeNoble, Traffic Engineer, Little Rock, Ark. Public Works, July, 1958.

"**Roadside Parks** on the Interstate Highway." This is the first half of a two-part article on the importance of roadside rest areas for the new limited-access Interstate Highways. By Wilbur J. Garmhausen, Chief Landscape Architect, Ohio Dept. of Highways. Highway Magazine, May-June, 1958.

"**Underground Parking Garage** Being Built at Harrisburg." By Jerry Pratt. Constructioneer, June 9, 1958.

"The Use of Colour in **Traffic Signs.**" Coloured road signs are being tested on several county roads in England. The Surveyor, May 17, 1958.

"Engineers Buy Time and Speed With an **Electronic Computer.**" Consultant develops useful computer pro-

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You can prevent costly tie-ups like this by ordering your Sterling Rock Salt—today!

Last year, many towns were caught without rock salt when early storms hit! Traffic was paralyzed, business suffered heavy losses, accidents mounted! Don't let it happen in your area this fall!

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grams to speed design and actual field operations. Contractors and Engineers, June, 1958.

"**Bonding Thin Concrete** to Old Pavements." By W. G. Westall, Airport and Highway Engineer, Portland Cement Association, Chicago, Ill. Civil Engineering, June, 1958.

"The Use of **Emulsified Asphalt** in Base Stabilization and Surface Course Mixes." Base and surface course asphaltic mixes are discussed fully in this article. By D. R. Gilley. Roads and Engineering Construction, May, 1958.

"**King-Size Test Road** Holds Future Answers." Test traffic is scheduled to get under way early this fall on the $22 million highway research project between Ottawa and La Salle, Ill., sponsored by the AASHO. Engineering News-Record, June 19, 1958.

"**Leasing of Motor Equipment.**" Nearly all of the pros and cons of leasing cars and trucks are set down in a factual way. By J. J. Carrell, Director of Training, International City Managers' Assn. Public Works, July, 1958.

"Virginia's **Richmond - Petersburg Turnpike Nearly Finished.**" Construction was financed by sale of $75,150,000 worth of bonds. By John Pershing, General Manager, Richmond-Petersburg Turnpike Authority. Better Roads, June, 1958.

• • •

Data on Municipal Water Works

During 1957, Little Rock, Ark., installed 60 fire hydrants. This brings the total number to 1,800 that have been installed inside the city and out. There were 1,243 services installed during the year, varying in size from ¾ to 6 inches.

The total number of customers in the Little Rock Municipal Water Works (metered and unmetered) are 35,324. The 1957 average monthly domestic water bill was $2.34. The average daily consumption of water was 18.3 million gals.

The chemicals used were as follows: Alum 569,400 lbs.; lime, 437,-300 lbs.; chlorine 105,764 lbs.; anhydrous ammonia, 6,079 lbs.; Calgon, 60,600 lbs.; soda ash, 4,500 lbs.; sodium silicofluoride, 92,195 lbs.

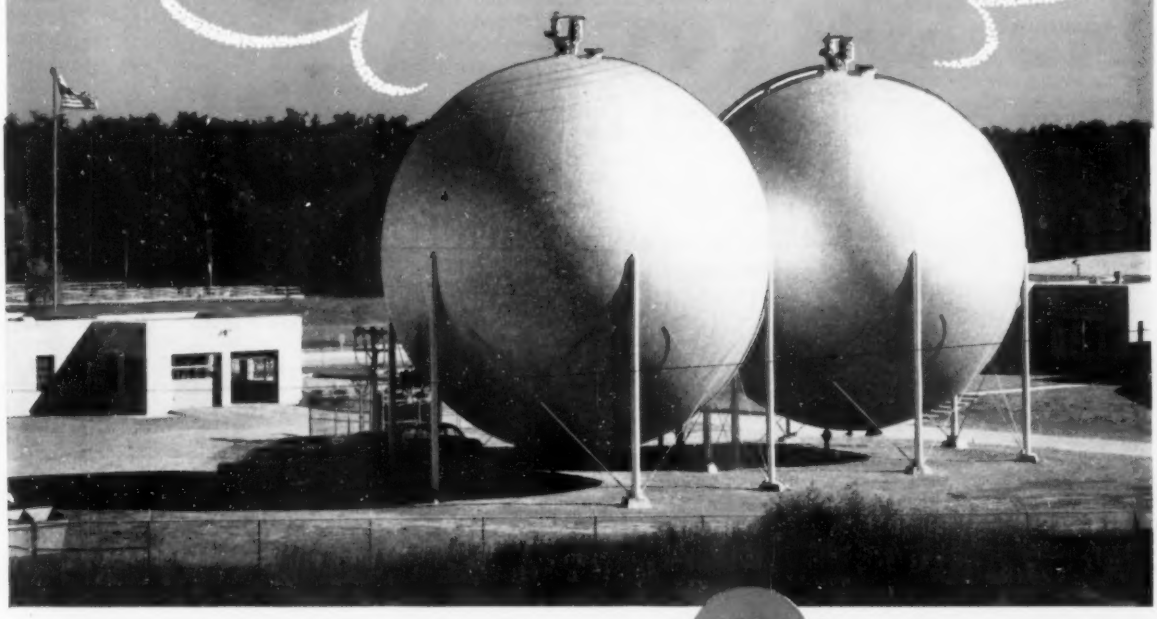
The above data appeared in the 1957 Annual Report of the Little Rock Municipal Water Works. The Chairman of the Board of Water Works Commissioners is H. J. Burford. The Manager-Engineer is L. A. Jackson and the Assistant Manager-Engineer is Jack H. Wilson.

4,100 Places To Stop; 6,744 To Park

There are more than 4,100 "STOP" Signs in the City of San Diego, Calif. according to "News & Views," a city publication. Also, there are 6,744 parking meters regularly serviced and 31,500 traffic, directional and street signs maintained.

HORTONSPHERES®

help reduce operating costs at South Bend treatment plant



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Continuing improvements by CB&I in design, testing, fabricating, and erection techniques and equipment — plus new tougher steels with higher yield strength, have considerably extended the volume of gas that can now be stored at high pressure.

PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

Well Construction in the Southwest

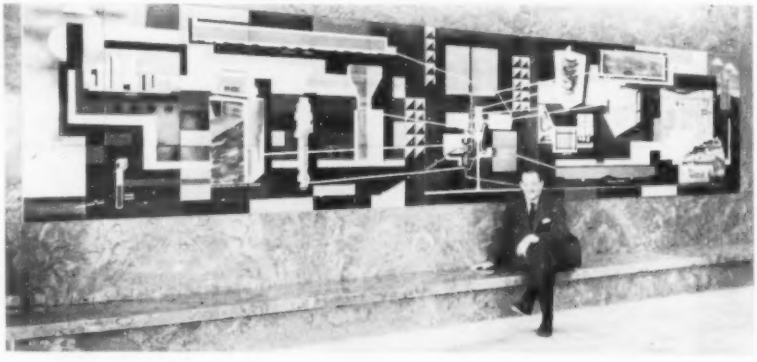
Engineers, in designing new facilities to accommodate the ever increasing demand for more water, are faced with a great number of problems. Perhaps the least understood of these problems is the proper design and construction of high-capacity water production wells. Suitable well casings must be selected, and methods and specifications for drilling must be devised. Basic concepts involved in water well construction by the cable tool and rotary methods are discussed in this article. The cable tool or percussion method of drilling is applied to the construction of most high-capacity wells in the western part of the United States. The bore hole is produced by the free fall of the bit suspended from the drilling machine on a wire line. Drilling motion is produced by the rapid raising and lowering of the tool. Factors that influence the drilling operation are: characteristics of the formation, frequency of motion, degree of line hitch or tension, tool weight, length of stroke and techniques by which cuttings are suspended and removed. The most efficient system employed in drilling unconsolidated formations is achieved with a combination of mud scow and hydraulic jacks. Cable tool wells are cased with either single-or double-wall casing, depending upon requirements, the single-wall casing being generally restricted to shallow wells of 16 inch diameter or less. All other factors being equal, the cable tool method is more economical to depths of approximately 1,500 feet. With wells to depths of 2,000 feet and greater, where formations encountered consist mainly of fine gravels, sands, and clay, the higher penetration rates achieved by the rotary machine tend to offset its higher operating cost. Recent production comparison tests between gravel envelope and nongravel envelope wells indicated no difference in specific capacity between wells. Careful consideration must be given to many factors when choosing the proper method of drilling a particular well. Cost, production, characteristics of aquifers, and other factors must be carefully evaluated before making a decision.

"Water Well Construction in Formations Characteristic of the Southwest". By Roscoe Moss, Jr. *Journal of the American Water Works Ass'n*, June, 1958.

Hammond's Waterworks

The city of Hammond, Ind., takes its raw water supply from Lake Michigan through an intake crib located about one mile from shore and from two smaller intake structures. From the intakes the water flows by gravity into a reinforced concrete shore well of 0.5 mg capacity which acts as a primary settling basin. Four low lift pumps transfer the water from the shore well into a raw water flume where chemicals are added. The principal coagulant now in use is aluminum sulfate. This chemical as well as all the others in use are being introduced in the liquid state. Activated carbon is used for taste and odor control and may be added at three different points in the treatment plant. Chlorine and ammonia may also be fed at three different locations. From the raw water flume, the water flows to twelve flocculating chambers and thence to the three sedimentation basins for a retention period of four hours before entering the filter plant. This has 12 sand filters, each with a capacity of 2.5 mg. at a 2-gal. per square foot rate of filtration. In 1957 a new high lift

Diagrammatic Mural at Filtration Plant



A COLORFUL, permanent surfaced diagrammatic mural executed in vitreous enamel on 16-gauge steel has been installed in Cleveland's Clague Road Filtration Plant. More than eight months were required for the Cleveland ceramic artist, Edward Winter, to apply and fire the enamels.

The mural depicts supply, treatment and distribution of water from the intake crib in Lake Erie, to the consumer. Cutaway diagrammatic drawings were made of pumps, traveling water screens, mixers, flocculating tanks, settling basins, filters and laboratory equipment. A master plan of the plant is at the center of the mural, with radiating lines showing the location of various types of equipment. The artist's design of the 42-section mural was based on drawings furnished by the consulting engineers, Havens and Emerson.

Murals of similar type furnished by Mr. Winter for Cleveland's Nottingham Filtration Plant were described in the January, 1958, issue of PUBLIC WORKS.

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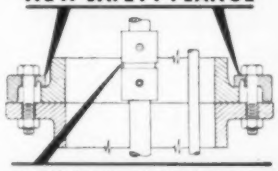

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These new important advantages are provided without sacrificing interchangeability of working parts with EDDY hydrants now in service. Now, more than ever, EDDY offers maximum fire protection, economical maintenance and assurance against future obsolescence in your fire-fighting system.

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WATERFORD NEW YORK

pumping station was completed and placed in service and the existing high lift pumps and steam plant were retired. This new pumping station with a total pumping capacity of 116 mgd is a fine addition to Hammond's water works and will meet the present and future water needs of the city's people and industry.

"The City of Hammond—in Step with Waterworks Progress and Prepared for the Future". By D. L. Gallagher. PUBLIC WORKS, July 1958.

Management Skills

Skilled management means the projecting of personnel and managerial needs into the future just as physical needs are projected. It means the utilization and development of imagination, intelligence, initiative, loyalty and experience, just as physical resources are developed. An attempt to concentrate management functions in the hands of a small executive elite wastes a large proportion of the human resources available to meet the problems of management. The failure of those who have special knowledge of water resource problems to share that knowledge with their community and guide policy toward a healthy future can result only in the greater problems brought on by public ignorance and apathy. These are a few of the basic conditions which determine the character of a management developed program. Given a recognition of those basic conditions, the detailed job of management development depends on the resources immediately available for the task. This article evaluates three approaches to the field of administration: the biographical, the legal and the sociological, and suggests the third approach for consideration by the municipal utility which must act as a responsible and participating member of the community.

"Development of Management Skills: Necessity or Fad?". By Richard H. McCleery. *Journal of the American Water Works Ass'n*, June 1958.

How Denver Fought the Drought

The City of Denver, Colo., had a drought extending over a five-year period from 1952 to 1956, inclusive. In the spring of 1954, the board of water commissioners became gravely concerned about the rate of depletion of the supply and initiated emergency conservation measures. Three approaches to the problem were available: 1) Emergency conservation of water; 2) emergency additional water supply; 3) speeding up of the long-range program to provide additional water for a growing city. The Denver water department embarked vigorously on all three programs. Restrictions were placed on lawn sprinkling and it was estimated that the city saved about 13.7 billion gallons of water over the three-year period 1954 to 1956, inclusive. Measures were also adopted for the conservation of water used for cooling, heating and industrial processes. It was estimated that about 6.4 billion gallons per year were saved by these conservation measures. New wells and galleries, dug along the valley of the South Platte River as emergency sources of water, produced over 3.6 billion gallons during 1955, 1956, and 1957. Cloud seeding operations over a five-year period did not prove effective as a means of increasing precipitation. In fact the five years during which cloud seeding was tried produced the lowest five-year period of runoff on record on the South Platte River. The longe-range improvement program, which had been outlined in 1952, was speeded

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Request Bulletin 503

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AQUA NUCHAR activated carbon has high affinity for all substances that commonly taint water supplies. Properly applied in sufficient dosage, it efficiently adsorbs tastes and odors from algae, decaying vegetation, trade-wastes and other matter, soluble and insoluble. Concentrations required average as low as 2-5 ppm for extremely economical control.

We have produced activated carbon for industrial use for over 40 years, so when you use AQUA NUCHAR you benefit by our experienced technical assistance. And since stocks of AQUA NUCHAR are always readily available from 25 strategic warehouses, deliveries can usually be made within 12-24 hours.

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up. The principal project was the extension of the St. Louis Collection Conduit. This was completed in 1955 making it possible to divert an additional 22,000 acre-feet of water. Also completed in 1955 was Gross Reservoir, a 42,000 acre-foot storage facility on South Boulder Creek. A third project was the enlargement of the Moffat Filter Plant from a rated capacity of 56 mgd to 112 mgd. In addition, the city has been blessed with unusually high runoff for 1957 and during the winter of 1957-58 the snowfall was so deep that the state engineer requested the City of Denver to reduce its storage to provide for flood control—a complete reversal of the situation of a little more than a year ago.

"How Denver Fought the Drought." By John Burgess. *Water Works Engineering*, June, 1958.

Water Law and Litigation

A struggle is on for the nation's water resources, and municipalities are in the thick of it. Pressure from growing populations makes cities strong competition for industry and agriculture. The task of furnishing an abundant and dependable supply of potable water at reasonable cost falls to the engineer. But it is up to the municipal lawyer to protect existing water sources and take the initiative in planning future supply based on firm water rights. This paper is a report presented to the convention of the National Institute of Municipal Law Officers, Richmond, Va., by the author, as chairman of the Committee on Municipal Water Problems. The survey points up these recent developments in the water problems of communities: (1) Water scarcity is growing more acute and spreading; it is no longer a sectional problem, but a national one. (2) Pollution is confounding efforts to reuse and supplement water supply. (3) Legislatures are slow in shaking off traditional water rights concepts to adopt comprehensive laws for coordinating both surface and underground waters. (4) Conflicts between municipal, state and federal authority are reaching agreement on many occasions, but leading to court battles on others. (5) Lawsuits and legislation aimed against municipal corporations are succeeding many times for their antiurban sponsors. (6) Water development is lagging behind demands of the population boom. (7) Plans for supplemental water are progressing despite profound legal and engineering problems. (8) Outside water service, eminent domain, and fluoridation continue as problems of municipal supply. (9) Conservation measures are increasing. The need to provide today for the water law problems of the foreseeable future calls for statesmanship and planning.

"Recent Developments in Water Works Law and Litigation". By Edward F. Taylor. *Journal of the American Water Works Ass'n*, June, 1958.

New British Reservoir

The need for increased water supply in Essex County, England, led to a joint venture of two water companies to share their resources and construct a $14½-million reservoir and treatment plant. In 1950 the two water companies serving the county of Essex, which is located outside London on the north bank of the River Thames, decided on this joint project. Work was completed in 1957 and now a million people in this area are being supplied about 6 mgd of softened water. The finished embankment forming the reservoir is 6,850 ft. long, 64.5 ft. high, 440 ft. wide at the base and 25 ft. wide at the top.

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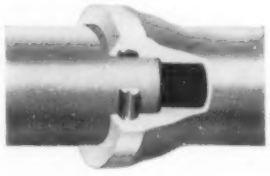

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The raw water's loaded with problems, but

Dubuque gets 100-hour filter runs with Permutit Precipitators

Influent at Dubuque's new Eagle Point water treatment plant is loaded with iron, manganese and a hardness of 320 ppm. When you're working with raw water like that, the chances for long filter runs would ordinarily be slim.

Yet two vertical Permutit *Precipitators* hold their blankets effectively even while handling the precipitates from this highly mineralized raw water. The effluent they produce is so low in floc-carryover that very little load is placed on the filters. Result: Getting 100-hour filter runs is no problem at all. Precipitation is complete, and there's no troublesome lime build-up on the filter sand.

The high efficiency of the *Precipitator's* unique upflow sludge blanket has shown up fast in low operating costs for the Eagle Point plant. Long filter runs mean less treated filter wash water is used, hence pumping and chemical costs are both reduced.

Permutit can help you come up with the right answer to your community's water problems. Just contact the Permutit office listed in your phone book. Or write to us directly. The Permutit Company, Dept. PW-8, 50 West 44th Street, New York 36, New York, or Permutit Company of Canada Ltd., Toronto 1, Canada.

PERMUTIT®

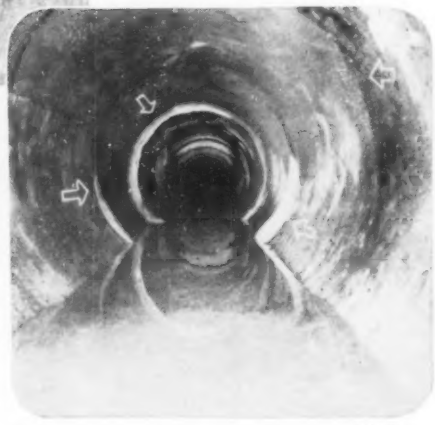
rhymes with "compute it"
a division of PFAUDLER PERMUTIT INC.
Water Conditioning
Ion Exchange • Industrial Waste Treatment

Costly waste, 20 gallons of water per minute

BEFORE

STOPPED with WATERPLUG Hydraulic Cement

Waterplug stops running water INSTANTLY!



AFTER

Here is what Underwater Services, Valley Station, Ky., had to say about Waterplug

On October 6, 1957, our Underwater Services Company was called upon to repair a major break in an underwater drainage system for the Hardin County Sportsmen's Lake at Elizabethtown, Kentucky. Upon diving to the bottom of the lake we discovered several large ruptures in the 24" tiles used in the drainage system. Water, uncontrolled, was pouring through these breaks at a minimum approximate rate of 20 gallons per minute. Using underwater diving equipment we managed to reduce this torrent by packing sandbags into the holes channeled through the four feet of earth covering these tiles. Descending through a water control tower, we gained access to the interior of the drainage tiles to the area of break-through. Above us were four feet of lake bottom and 20 feet of water above that. Under these extremely adverse conditions we used the Thoro System WATERPLUG Cement to repair the breaks from the interior of the tiles.

Because of the simplicity and ease of mixing and applying WATERPLUG Cement, we were able to completely and effectively repair these breaks in the drainage system.

We were delighted with the effectiveness of WATERPLUG Cement in successfully overcoming this difficult water repair problem. Feel confident that in future underwater repair problems, our company will rely upon WATERPLUG Cement.

"How to do it" GET OUR 16 PAGE BROCHURE

STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNA. CENTERVILLE, IND.

The reservoir's capacity is 5,968 mg, with a maximum depth of 55 ft. and an average depth of 25.16 ft. The water being supplied to the reservoir is taken from the Chelmer and Blackwater Rivers. At the river intake there is a coarse filter; a finer self-cleaning screen is located separately near the pumping station. Pumps send water to a supply chamber from where it flows under gravity to the treatment plant. Softening to the required hardness (not exceeding 150 ppm) is accomplished with lime and soda ash. Softening is supplemented by coagulation with colloidal silica, produced by the partial neutralization of the alkali in sodium silicate by sodium bicarbonate and then applied to the Accelators of the upward-flow, sludge-blanket type, each with a capacity of 250,000 gal. Recarbonation of the softened, clarified water is accomplished by bubbling carbon dioxide through tubular bubblers to bring the pH down to 8.0. The recarbonated water flows from the contact tank to eight rapid sand filters, with a total capacity of 12 mgd, the filtrate entering a 2-mg clear water reservoir from where it is pumped by six centrifugal pumps into the distribution system.

"New British Reservoir, a joint venture." By William A. Heath. *Water and Sewage Works*, June, 1958.

Taste and Odor Problems

Tastes and odors have constituted a major problem at the Valparaiso, Ind., water treatment plant for years. In the late fall, and again in February, the lake "turns over" due to temperature changes. During these periods a very objectionable taste is experienced. The algae problem still is a major one, but it has been made easier to control through improved laboratory analytical procedures. First, laboratory control is more complete. Algae counts are made on the raw water at least once each week. These counts include the numbers of algae per milliliter and the types. From these counts it is possible to determine which algae produce the bad odors, and the count at which treatment must begin in order to keep the threshold odor level from getting too high. Observations of the temperature of the raw water entering the plant is of great importance in controlling tastes and odors of the finished water. Sudden temperature changes indicate a rapid turnover in the reservoir with a likelihood of increased taste and

Want cobwebs on your complaint phone?

Then use Calgon* — for Calgon stops red water and lime scale — the two main causes of customer complaints. Yes, you can turn complaints into compliments, because whether the "red water" comes from iron present at the source, or iron dissolved from the pipes by corrosion, Calgon treatment is the answer.

When well waters containing iron and manganese are treated with a few parts per million of Calgon, the iron and manganese are kept in solution and the water is as clear at the consumer's tap as it was when pumped from the well.

When red water is caused by iron dissolved from the pipes, it can be prevented with Calgon† treatment because Calgon forms a protective film on metal surfaces. Moreover, this protective film also reduces costly tuberculation damage, flows are kept high and pumping costs are reduced. Calgon treatment is particularly effective after water main cleaning since the protective film forms quickly and tuberculation never gets a chance to start.

A report of a twenty-four month study on the efficiency of Calgon in maintaining pipeline flows is available. Ask for a reprint of this paper.

Write or phone for more information. An experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

* Calgon is the Registered Trade Mark of the Calgon Company for its glassy phosphate (sodium hexametaphosphate) products.

† Fully licensed for use under U.S. Patents 2,337,856, 2,304,850 and 2,358,222.

CALGON COMPANY

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
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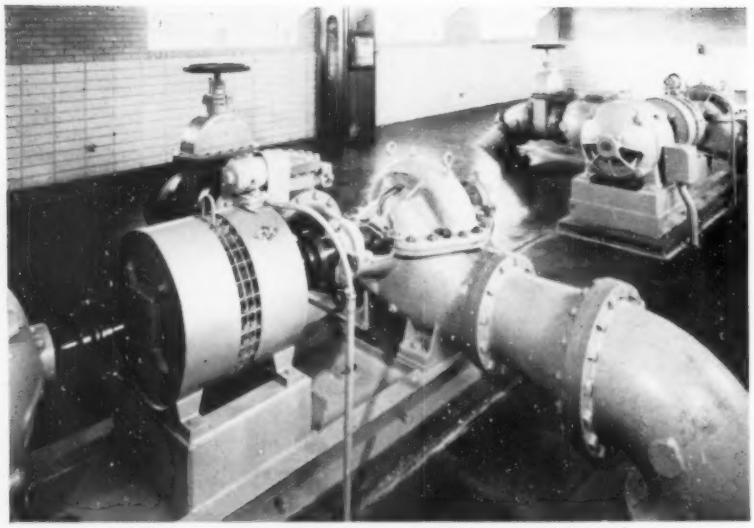


E-M Ampli-Speed Drives provide Odessa, Texas Municipal Sewage Plant with adjustable pumping rate of 1 to 5.4 MGD. Pumps are held to ±2% of manually selected speeds.

Make two pumps do the work of three!

Here's how Odessa, Texas did just that with adjustable speed E-M Ampli-Speed Drives

PROBLEM: Odessa, Texas wanted to increase sewage facilities to treat sewage effluent as a source of industrial water for chemical and rubber plants.

OBJECTIVE: They needed a new, efficient sewage pumping station at minimum cost, with provision for future capacity.

SOLUTION: Odessa officials called in Parkhill, Smith & Cooper, consulting engineers of Lubbock, Texas. P. S. & C. suggested two alternatives: 1. Build a plant with three pumps, including one for peaking and standby; or 2. Install two pumps with E-M Ampli-Speed Drives.

Parkhill, Smith & Cooper favored the 2-pump plan for these reasons:

Minimum Capital Investment. The three-pump plan would tie up a considerable amount of capital in an extra pump, motor and control without adding appreciably to the volume of sewage pumped.

100% Peak Standby Capacity. Two pumps with E-M Ampli-Speeds could handle present demand efficiently, yet still have enough reserve capacity for 100% peak standby.

Low Cost Expansion. Later another pump could be added to *double* the station capacity and still allow 100% peak standby. And as a further saving, the building would *not* have to be enlarged to accommodate this third pump.

RESULT: Odessa took the advice of its consulting engineers and is now enjoying efficient, low cost pumping.

As your pumping requirements grow, you too will want the economy and versatility that E-M Ampli-Speed Drives give you. Write the factory today for descriptive Ampli-Speed Bulletin No. 243, and call your nearby E-M Sales Engineer for details.

E-M

ELECTRIC MACHINERY MFG. COMPANY

MINNEAPOLIS 13, MINNESOTA

Specialists in making drives do **EXACTLY WHAT YOU WANT THEM TO**

odor problems. Temperature of the water going to the distribution system also presents a problem, because the higher the temperature the more noticeable are the tastes and odors. Another important factor in taste and odor control is the application point of the chemicals to provide sufficient contact time. A plant expansion program was completed in 1950 which consisted of the addition of a 485,000-gal. clarifier in series with the old settling units which provided sufficient settling time to allow use of carbon. It has also been found that much better results are obtained with less carbon if the carbon can be applied first and sufficient time allowed for adsorption before breakpoint chlorination is applied.

"Taste and Odor Problems in Valparaiso, Ind. By Richard Coote. *Water and Sewage Works*, June, 1958.

Other Articles

"**Pollution Control** in Southwestern Reservoirs and Watersheds". A panel discussion presented on October 15, 1957 at the Southwest Section Meeting, Oklahoma City, Okla. By L. F. Pummill, G. T. Kellogg, H. L. Dabney, W. H. Bell. JAWWA., June, 1958.

"Correlation of the Two Principal Methods of Calculating the **Three Kinds of Alkalinity**". This article presents a theory regarding the relations between the stoichimetric and ionic systems of alkalinity in the pH range above the biocarbonate endpoint and provides two monographs which will facilitate the conversion from one alkalinity system to the other system. By John F. Dye. JAWWA., June, 1958.

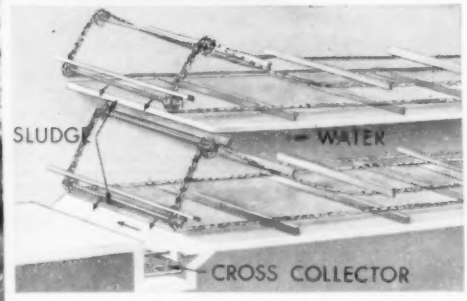
"Developments in the Design and **Drilling of Water Wells**". Proper well construction must not only restrict the flow of sand but must be capable of supplying all of the desirable underground water available as shown in this article. By Samuel T. Guardino. JAWWA., June, 1958.

"**How to Size Services and Meters**". Some valuable information on flow in gpm through different size services and meters at varying pressure losses between main and meter outlet. By D. R. Taylor. Public Works, July, 1958.

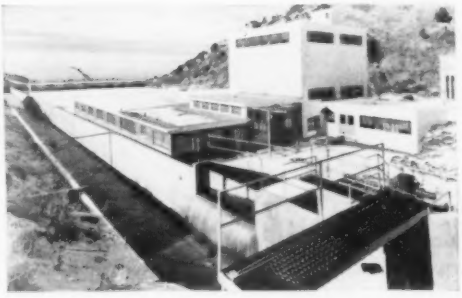
"Purposes and Policies of the Joint Committee on Uniformity of Methods of Water Examination". An official release of the JCUMWE expressing their objective of securing uniformity of methods of water examination by the 11 member organizations. JAWWA., June, 1958.

"**Iron and Manganese** in Water Supplies." A discussion of concentrations of iron and manganese in water supplies and the various methods of control and removal. By Thomas M. Riddick, Norman L. Lindsay, and Antonio Tomassi. Jour. AWWA., May, 1958.

Double-deck clarification plant! *LINK-BELT equipment at Salt Lake City cleans 32 million gpd*



TWO-STORY TREATMENT. Diagram shows one of eight double-deck settling tanks equipped with Link-Belt sludge collectors each over 300 feet long. Coagulation chambers are also Link-Belt.



INTAKE WATER is received from adjacent hydro-electric plant or by-pass canal. Leaves, sticks and other large debris are removed by a pair of Link-Belt traveling water screens.

SALT Lake City's water supply comes from mountains east of the city, carrying with it—during flash storms or fast thaws—solids amounting to as much as 60 ppm.

Called on for facilities to remove solids and purify the water, the consulting engineers were presented two unusual challenges. Topography made compactness essential—and settling tanks had to be protected from freeze-up. Both were overcome by *Double Deck enclosed* tanks, equipped with Link-Belt longitudinal sludge collectors. With this system, the Big Cottonwood plant has reduced solids to 3 ppm.

Just as Link-Belt cooperated with Consultant John A. Carollo and Associates, Phoenix, we invite the opportunity of working with you, your chemists and consultants to produce top efficiency in water, sewage or waste treatment. Call your nearest Link-Belt office.

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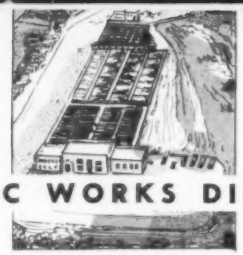
LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,869-B



PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D.
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Sludge Digestion: Small Plants

Sludge digestion facilities represent major components of small sewage treatment plants. Anaerobic and aerobic digestion of sewage solids are practiced currently, the former being accomplished in septic tanks or in the digestion compartment of a two-story tank or in separate sludge digestion tanks. The aerobic digestion method has been used in recent years in small plants and consists in employing long-term aeration. Sludge disposal facilities may be provided for either raw or digested sludge and may include the use of lagoons or sludge drying beds or in the higher capacity range it may include the use of vacuum filters for dewatering with or without subsequent heat drying or incineration. Factors which influence the size and design of sludge digestion facilities are discussed in detail in this article. The design requirements of various states are given together with the "Ten States Standards" which embody good design practice. A summary of equipment available for sludge digestion and disposal for small sewage treatment plants is provided.

"Small Sewage Treatment Plants: Sludge Digestion." By John J. Baffa. PUBLIC WORKS, July 1958.

Rodent Control on Dumps

Rats spawned on insanitary dumps are a constant health hazard and a source of economic loss to the surrounding community. The best control for this pest on dumping grounds is to remove or prevent access to the food and shelter that attracts them by means of effective sanitary techniques, such as a sanitary landfill or incineration. A number of rodenticides are available, some of them being more effective than others. However, the effectiveness of all poisons is directly proportional to the bait components (several are given); the thoroughness with which they are mixed; and the placement of the finished bait. Precautions must be observed as some of these rodenticides are highly toxic (1080 and thallium sulfate) to man and to domestic animals; others are relatively safe to both man and domestic animals (red squill and the anticoagulants — Warfarin, Pival, Fumarin and Diphacin). With heavy rat infestations it may be preferable to treat the dump first with a fast-acting (highly toxic) poison and then follow it with one of the anticoagulants upon which the rat feeds for 3 or more days before death occurs through internal bleeding. Calcium Cyanide gas (Cyanogas A Dust) may be used against rodents which may have established themselves in undisturbed ground adjacent to the dumping areas. While reasonably safe out-of-doors, this gas will kill all forms of life including humans and should be handled only by responsible persons well aware of its hazards.

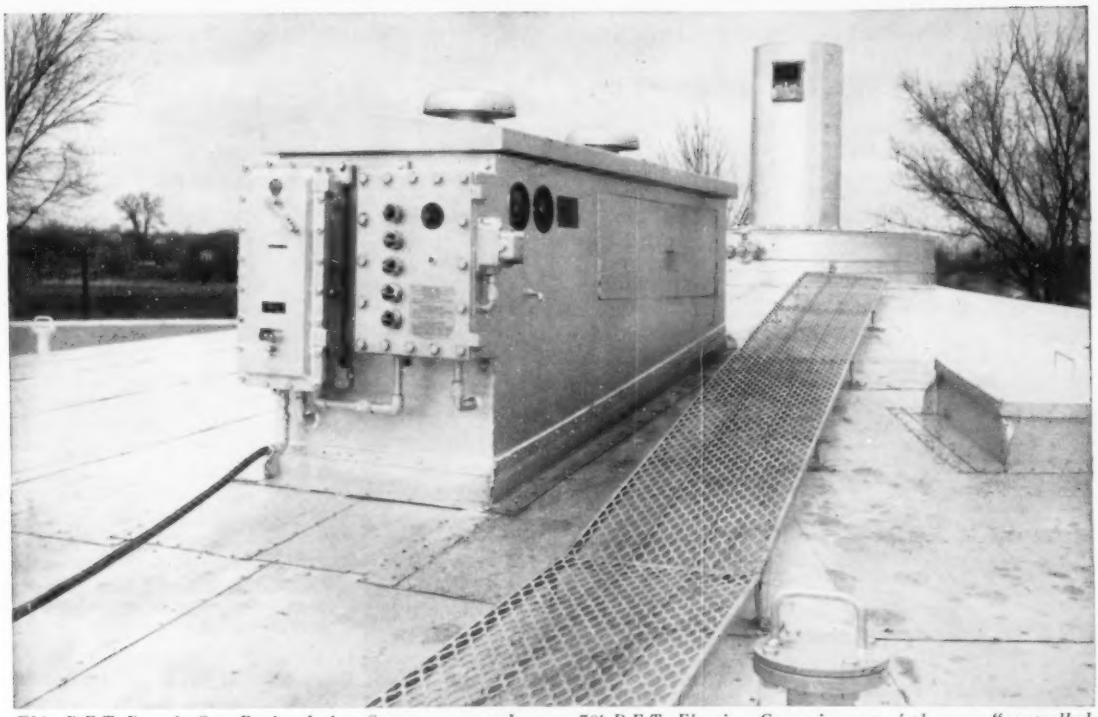
"Control of Rodents on Dumps." By William D. Fitzwater. PUBLIC WORKS, July 1958.

Sewers for Man-Made Islands

Fort Lauderdale's growth, like that of other Florida cities, has been tremendous since the end of World War II. During this period the population has increased over 400 percent to its present estimated size of 85,000 persons. Constructing a sewer system to serve the man-made islands in the Las Olas Island section of the city presented unusual

Wet Weather Presents Problems at Busy Landfill Site

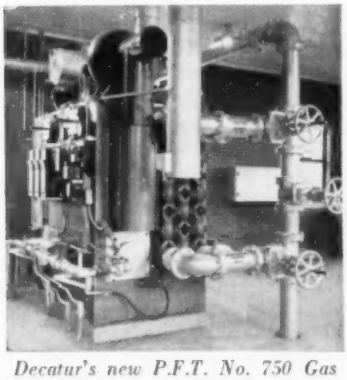
LANDFILL operations for Houston, Tex., are located in a low, coastal plain area. Three years ago, International Drott Bullclams were purchased for the job. Today, eight International crawlers are in constant use—four are International TD-24s which pull scrapers to excavate for the garbage, to haul cover soil to complete the fill and to doze out the pits in wet weather. Three International TD-18s are used for piling and burning brush with a TD-14 assisting. One of the problems the city encounters is the low elevation which requires drainage channels to be dug for use during rainy seasons. The illustration shows how severe conditions may get. Another problem is that eight oil wells have been drilled here and are producing in the landfill center. Operations are so heavy at this landfill site, that it is in operation 7 days a week, 24 hours per day.



This P.F.T.-Pearth Gas Recirculation System mounted on a 70′ P.F.T. Floating Cover is part of the new "controlled digestion" system just added to the Decatur, Illinois sewage treatment plant. Design of plant by Warren & Van Praag, Consulting Engineers, Decatur.

Decatur, Illinois installs complete modern P.F.T. "Controlled Digestion" system

Unusual industrial and population growth has called for the modernization and expansion of Decatur's sewage treament plant three times in recent years. Each time Decatur has selected P.F.T. equipment.



Decatur's new P.F.T. No. 750 Gas Fired Heater and Heat Exchanger, with accessory group B, controls, provides full automatic digester temperature control.

The P.F.T. equipment furnished for the most recent expansion is a new digestion system which includes: a 70′ P.F.T. Floating Cover with prefabricated aluminum roofing; the P.F.T.-Pearth gas recirculation system and Model 750 Digestion Heater and Heat Exchanger shown; plus a complete new system of gas piping with P.F.T. gas safety equipment.

The P.F.T.-Pearth gas recirculation system includes a gas compressor rated to deliver 150 cfm at 10 psi powered with a 10 hp motor. Controls are provided to automatically discharge to each of 4 peripheral discharge wells in sequence.

The wells are equally spaced around the cover extending to a depth of approximately 10 feet below the liquid level in the tank. The compressor and low and high pressure bypass controls are mounted on the floating cover in an insulated housing.

P.F.T.-Pearth gas recirculation provides the most effective means of controlling scum formations. This allows the use of the full Digester capacity. Combined with close temperature control with a P.F.T. Heater, rapid and complete digestion is assured. Decatur's new "controlled digestion" system is now geared to meet the needs of this fast growing community.

Waste Treatment Equipment
Exclusively since 1893

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PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
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PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

and difficult problems of design and construction. The general procedure in constructing the islands was to chop down the mangrove trees, a medium-size bushy growth native to tidal mud flats in Florida, and to place fill directly upon the mat of fallen trees, by means of hydraulic dredge. Differential settlement of the earth mass created uncertain loading conditions of great magnitude. Under these conditions, rigid sewer construction was impractical. Specifications for the sewer project have permitted the use of preformed plasticized polyvinyl chloride joints with vitrified clay sewer pipe. The solution to the problem of distributing any settlement over as many of the flexible joints as possible, thus reducing the deflection per joint, was provided by establishing four different foundation types to suit the four particular soil conditions in the area. Primary means of dewatering has been by well points. Each island requires its own ejector station to lift sewage over the bridges into the interceptor sewer which will carry the sewage to the new treatment plant being constructed at Port Everglades in the southern portion of town. Twenty-six lift stations were required in the area. The total contract, including lift stations and force mains, was $1,431,027. (See also "Sewerage for the 'Venice of America'", PUBLIC WORKS, Feb., 1958.)

"Sewers for Man-Made Islands". By Arthur W. Saarinen. *Wastes Engineering*, June, 1958.

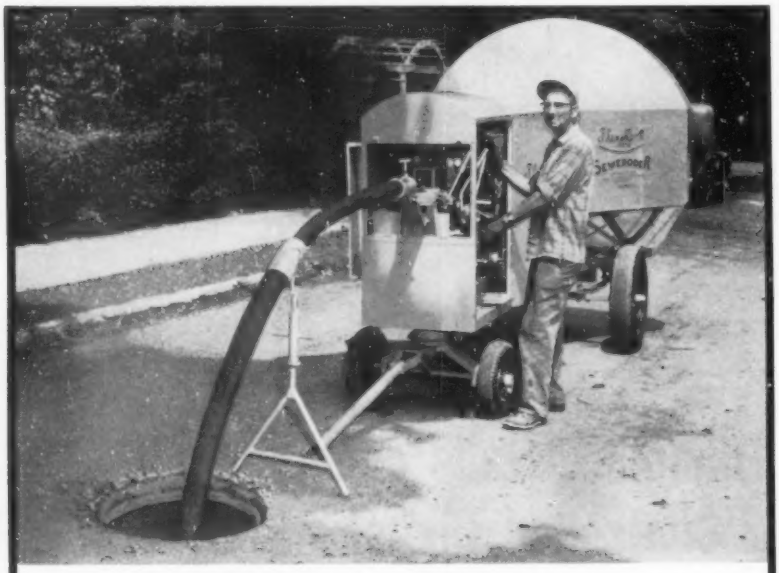
Garbage Digested with Sludge

In 1948, the capacity of the Richmond, Ind., activated sludge plant was increased from 6 mgd to 11 mgd to include the disposal of garbage at the treatment plant. The procedure is for each loaded collection truck to be weighed. The truck then dumps into the hopper which has a metal belt conveyor bottom. The raw garbage is removed by a metal conveyor over the picking table, dumped into a Jeffrey garbage grinder, and passed through a Jigrit washer into a slurry tank from which it is pumped into one of the two 95-foot digesters equipped with floating covers. Full value of the gas generated is obtained by using the gas for heating all plant buildings, for compressed air production and for pumping return sludge in the activated sludge secondary treatment plant by means of gas engines. The gas produced amounts to better than 100,000 cubic feet per day and the average amount used is 88,500 cubic feet per day, the value amounting to $20,972.90 for the year 1956. At this rate of return the cost of the garbage disposal equipment would be paid for in five years. Central grinding and disposal with sewage sludge has been and is satisfactory.

"Digestion of Garbage with Sludge Yields Gas Worth $21,000 per Year." By William Edwin Ross. *Wastes Engineering*, June, 1958.

Insect Control on Dumps

Although many of the insects breeding in dump areas are of little medical importance, a few species, particularly flies and mosquitoes, constitute hazards to man by acting as disease carriers. Sanitary fills or incineration provide the most satisfactory method of controlling such insects. Pending adoption of these methods, a well-planned program of insecticide application should be employed. House flies and blow flies breed prolifically in decaying organic matter. In recent years house flies have become resistant to chlorinated hydrocarbon insecticides such as DDT and BHC but they may be controlled with dry or liquid baits



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NOTHING COMES CLOSE to a SeweRodeR!

Here's Why:

- Cleans up to 900 feet NON-STOP with one operator.
- Cleans more footage daily, at lowest cost, due to its speed.
- Cleans all pipe sizes—doesn't just merely *unplug!*
- Automatically controls PUSH AND PULL POWER—from 4 pounds up to 4,000 pounds.
- Variable Push and Pull control from "inches" up to 50 feet per minute.
- Push or Pull Rods independent of rotation.
- Clicking of safety clutch warns of heavy obstruction.
- Positive footage meter shows exact location of tool.
- Safer! Operator never touches rotating rods.
- Sets up from street level. Works water-filled manholes.

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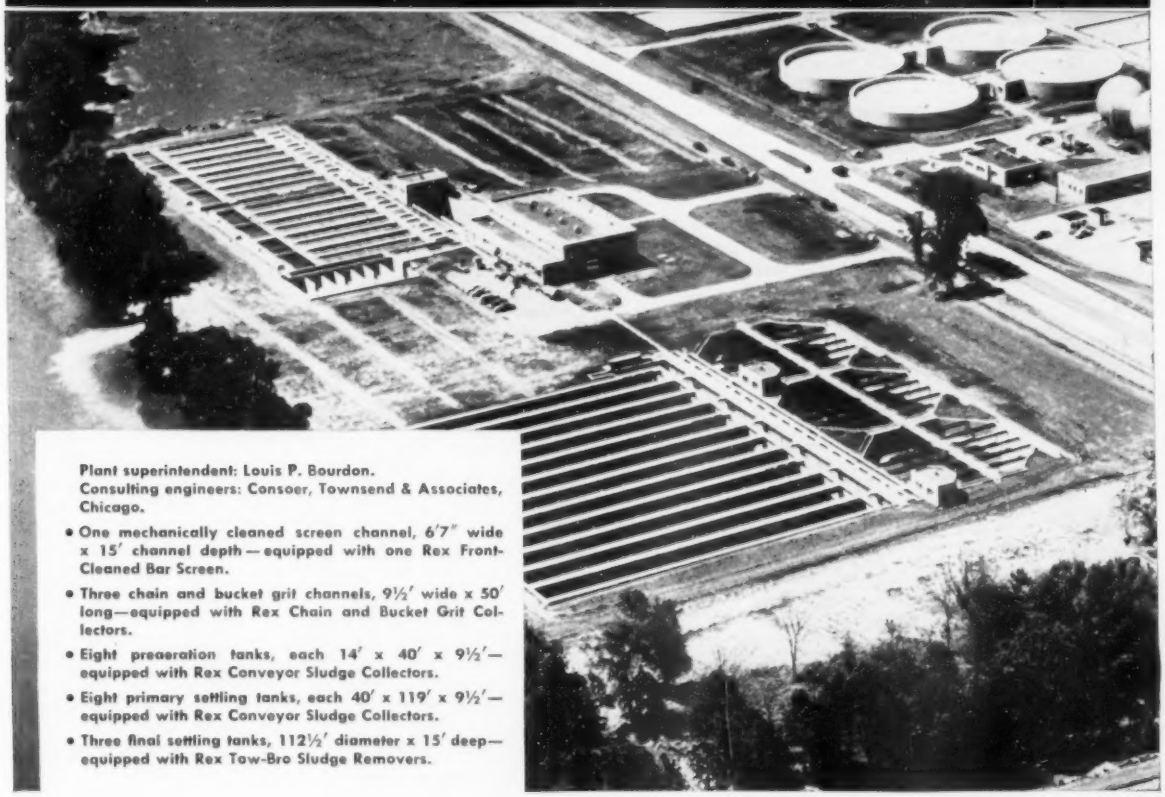
WORLD'S LARGEST MANUFACTURER OF SEWER CLEANING EQUIPMENT

SOUTH BEND SEWAGE TREATMENT PLANT...

Model of modern design



Plant superintendent: Louis P. Bourdon.
Consulting engineers: Consoer, Townsend & Associates, Chicago.

- One mechanically cleaned screen channel, 6'7" wide x 15' channel depth—equipped with one Rex Front-Cleaned Bar Screen.
- Three chain and bucket grit channels, 9½' wide x 50' long—equipped with Rex Chain and Bucket Grit Collectors.
- Eight preaeration tanks, each 14' x 40' x 9½'—equipped with Rex Conveyor Sludge Collectors.
- Eight primary settling tanks, each 40' x 119' x 9½'—equipped with Rex Conveyor Sludge Collectors.
- Three final settling tanks, 112½' diameter x 15' deep—equipped with Rex Tow-Bro Sludge Removers.

The South Bend, Indiana, sewage treatment plant is a model of modern plant design and operation. This plant, which recently went into operation, is designed to function both as a conventional activated sludge and a split activated sludge treatment plant. It processes an average daily flow of 48 m.g.d. Optimum flexibility in treatment and operation was designed into this plant which can partially treat a peak flow to 80 m.g.d. To assure translation of design efficiencies into actual performance...provide maximum operating economy, CHAIN Belt's modern waste treatment equipment was installed in both the primary and secondary treatment stages.

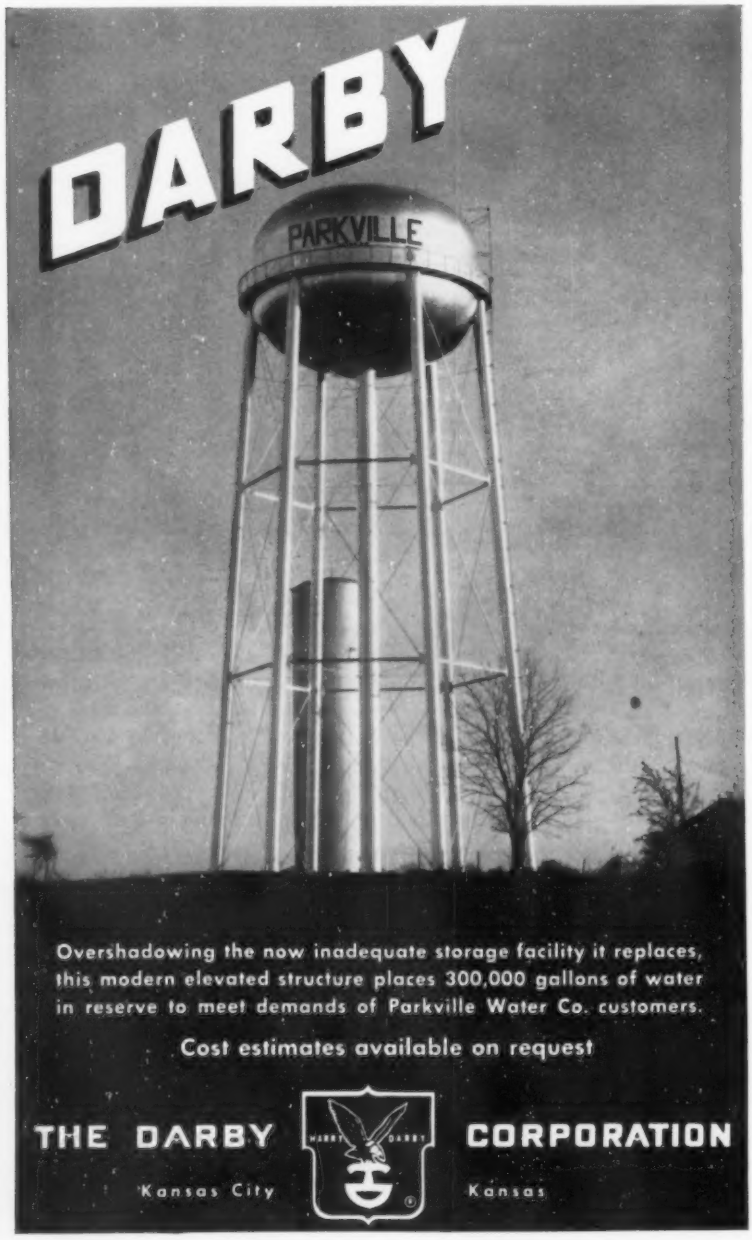
A Rex Front-Cleaned Bar Screen and Rex Grit Collectors provide effective removal of large and inorganic solids. Rex Conveyor Sludge Collectors in the preaeration and primary settling tanks assure efficient preliminary treatment, and positive sludge and scum removal. Rex Tow-Bro Sludge Removers in the final sedimentation tanks provide the positive, gentle sludge removal so important in handling the light, "tricky" sludges encountered in the conventional and split activated sludge treatment processes.

Modern, performance-proved CHAIN Belt equipment and the broad experience of CHAIN Belt engineers provide the right combination for most effective results and maximum operating economies. For information on the complete line of Rex Sanitation Equipment, write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT

or sprays containing organophosphorus insecticide, such as malathion, Dipterex or Diazinon. Liquid baits are particularly useful when large populations of blow flies are present. Blow flies do not readily consume dry baits, but both blow flies and house flies will feed on baits containing 2 percent of malathion, Dipterex, Dow ET-57 (commercially known as Korlan), or Diazinon in a 50 to 75 percent solution of malt or molasses in water. Dry or liquid baits provide spectacular immediate control but little residual control and therefore should be applied daily for 2 or 3 weeks and then reduced to once every 2 or 3 days or as necessary. Contact sprays may be used, but residual sprays are usually more satisfactory for the treatment of dumps. The contact spray is effective only if it comes in contact with the insects either in the air or while at rest. The residual sprays are slower-acting but are effective over a longer period of time as they are sprayed directly on the surfaces upon which the flies rest, and little is lost due to evaporation or drifting. These sprays can be prepared from wettable powders or emulsifiable concentrates of malathion, Dow ET-57, or Diazinon to form a 2 percent suspension which is dispersed at the rate of 2 gallons per 1,000 square feet. Mosquitoes may also be found in dumps, where they breed in containers holding stagnant water. The residual sprays mentioned previously are suitable for spraying the dumps, the containers, and the surrounding trees, shrubs, buildings, etc., where adult mosquitoes rest during the daytime. Hand-operated sprayers or large power sprayers or fog generators are available; the selection should be based depending upon the area to be sprayed and other factors.

"Application of Insecticides at Dumps." By G. C. LaBrecque. PUBLIC WORKS, July 1958.


DARBY
PARKVILLE
Overshadowing the now inadequate storage facility it replaces, this modern elevated structure places 300,000 gallons of water in reserve to meet demands of Parkville Water Co. customers.
Cost estimates available on request
THE DARBY CORPORATION
Kansas City
Kansas

A Planned Landfill Operation

In May, 1954, Ames, Iowa adopted the sanitary landfill method of refuse disposal. For the past two years the city has practiced the area method of fill on a site being developed for future industrial use. The article deals more with the control rather than the actual operation of the sanitary landfill. The following steps were considered in planning for future development of the property: 1) Develop an overall street plan to serve the area. 2) Design necessary utilities for the area. 3) Establish final contour map for the area. 4) Develop an overall site plan for the area. The street layout as planned prior to the start of landfill operations makes certain that no refuse will be deposited in a street or alley right-of-way, as this could complicate installation of future utilities and street surfacing. There were no utilities in the area so the sanitary sewer and water main extensions to the area were designed and the main trunk lines may be constructed in the next few years. A storm sewer system was designed and is being constructed in stages immediately ahead of filling operations. Natural gas, electricity and telephone service can be supplied as needed. Finally an overall site plan is now in the making. AID, Inc. (Ames Industrial Development) is working with architectural consultants on this plan for good industrial sites on the land in question. It was estimated that some 15,200 tons of material was hauled to the site during the first year's operation at a cost of $24,611.56, or a per ton cost of $1.62.

"Bury Garbage According to Plan." By J. M. Carpenter and Lloyd A. Dove. *The American City*, June.

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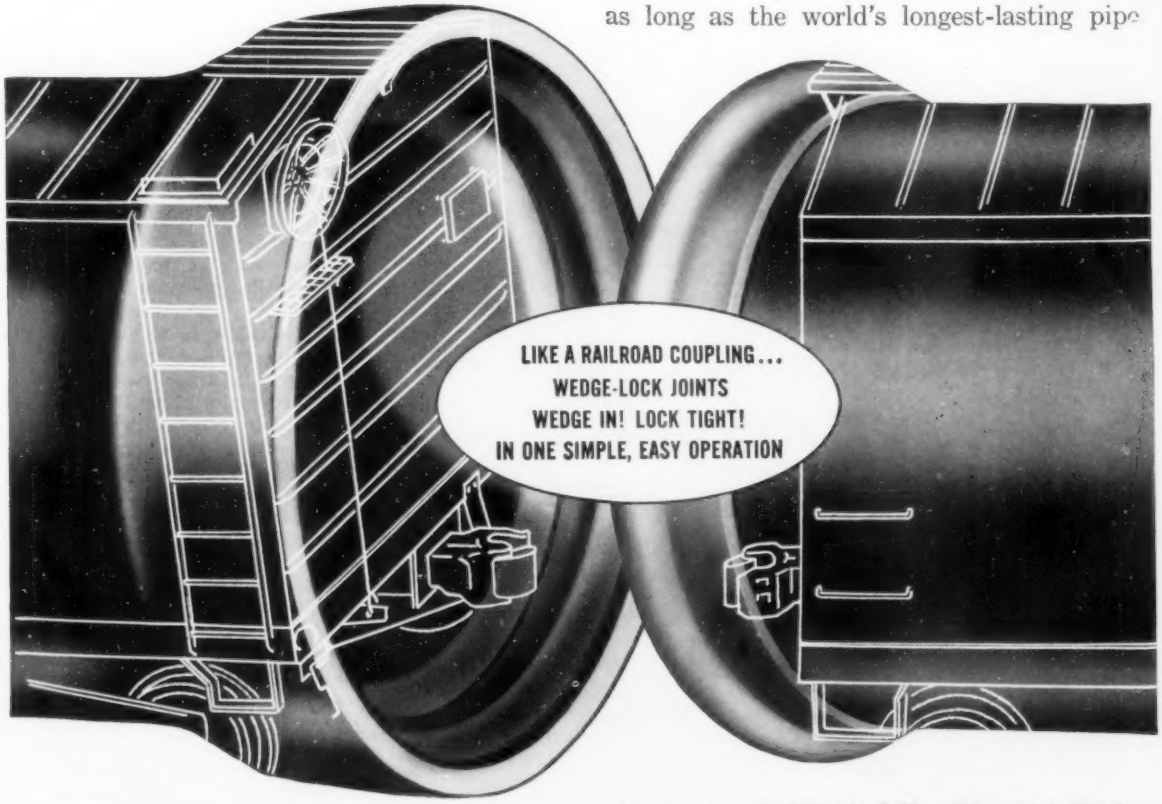

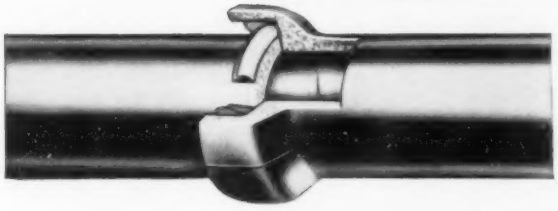

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Storm Water Drainage

In 1954, the city of Albert Lea, Minn., began a drainage survey of a developing area in the southeast section of the city. It was also decided to investigate the possibility of correcting a drainage problem in an adjacent built-up area which was being flooded repeatedly by surface water. A number of designs were considered before one was decided upon. The plan which was developed consisted of a pumped storm sewer system for the upper area with both areas to use a common trunk sewer discharging into Albert Lea Lake. The total capacity to be provided in the upper area was determined to be 52 cfs. The existing sewer had a capacity of 6 cfs thereby leaving 46 cfs to be provided by the pumping facilities. This was provided by two propeller pumps each with a capacity of 10,400 gpm pumping into a 30-in. cast iron pipe force main operating against a normal head of 37 feet and a maximum head of 42 feet. The pumps are automatically controlled and set in a reinforced concrete sump of approximately 36,000 gallons capacity, or 1.75 times the capacity of the lift station. The Virginia Place Lift discharges into a 42-in. reinforced concrete trunk sewer which is about 5,600 ft. in length and enlarges gradually, to accommodate additional drainage areas, from 42 to 54-inch at the outfall of Albert Lea Lake. In 1957, the City constructed another storm water pumping station of 10,600 gpm capacity, discharging into a 30-in. reinforced concrete outfall sewer of 200 ft. length. The City has completed plans for a third storm water pumping station which is proposed for construction in 1958.

"Line Storage Reduces Storm Water Pump Sump Size." By Raynold O. Folland. PUBLIC WORKS, July 1958.

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Storm Sewer Construction Cost

In Milwaukee, although there is little difference in the mileage of storm and sanitary sewers constructed under an annual seven-million-dollar program, the cost of storm sewers has been two-thirds of total available funds. Consequently, it is important that the sewer designer give proper consideration to the economics of various types of construction. The City uses the rational method of determining runoff, with a 3½-in. per hr. intensity for a 15-minute duration as a design basis. Sizes and slopes are determined by using the Chezy formula with Kutter's coefficient for circular conduits and Manning's formula for box sewers and open channel design. In a study of the bid prices of storm sewer construction for the last three-year period, the prices were averaged for each size and each type of construction. The average lineal foot prices were divided by the cross-sectional area to find the average cost per square foot of cross-sectional area. A tabulation of sizes, types, and cost per square foot showed that the City has obtained its "best buys" in hydraulic capacity with the reinforced concrete box sewers and large diameter monolithic reinforced concrete sewers. The overall range of costs of all types and sizes was $1.14 to $40.50 per sq. ft. of cross-sectional area. The 12-in. storm sewer, which might be considered relatively inexpensive, is shown to be $5.50, very costly on a square-foot basis.

"Economics of Storm Sewer Design." By Walter P. Schmitz. *American Public Works Association Engineers News Letter*, June, 1958.

Sewage Works Operator Training

Many small and medium-sized sewage treatment plants never pro-

duce the expected results for one of a number of reasons. The key to the situation in any case, and the most important factor in effective sewage treatment, is the plant operator. The purpose of this paper is to take a look at his problems and to summarize the results of the program in the State of Iowa that is designed to help the operator help himself. It also suggests that the Federation of Sewage and Industrial Wastes Association or the U. S. Public Health Service assume the responsibility of coordinating the best parts of the many successful training programs in order to develop the most successful program possible. Such an approach might be outlined roughly as follows: 1) Correlate, draw from, and build upon current successful programs; 2) on request, help local groups develop their own training and certification programs; 3) direct the development of such operator services as a simple laboratory manual and a safety program; and 4) work toward a public relations program particularly aimed at helping responsible public officials understand that the most economical sewage treatment is achieved by operators who are well qualified, well trained, and well paid. The education program in Iowa, which has been in operation for two years is under the joint sponsorship of ISIWA, the State Health Department, the State University (Iowa City) and the State College (Ames). During these two years, a total of 200 operators have completed the course and 91 have qualified for certification so that the State of Iowa now boasts over 250 certified operators and a continuing, enthusiastic demand for operator training.

"Operator Training—The Key to Effective Sewage Treatment." By Harris F. Seidel. PUBLIC WORKS, July, 1958.

Algae Effects on DO and BOD

Cooperative state-industry stream studies were conducted jointly during 1955 and 1956 by the Wisconsin Committee on Water Pollution and the Sulphite Pulp Manufacturer's Research League, Inc. These studies were directed toward evaluation of stream loading and purification capacity. As the studies progressed, it became apparent that it would be necessary to evaluate the effect of algae on the purification capacity of the stream. Attempts to evaluate this effect were made in 1956 in conjunction with the cross-section surveys of the Fox River which

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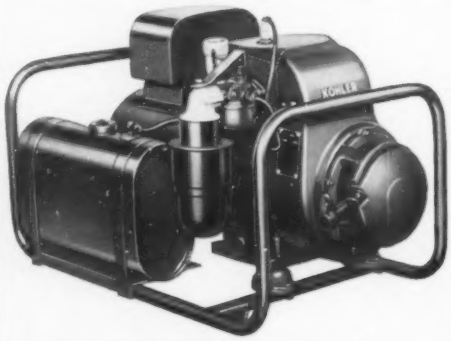

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forms one of the major drainage basins in Wisconsin. The two principal sources of wastes of man-made origin being discharged to the stream are from the pulp and paper industry (treated and untreated), and treated sanitary sewage. Several additional sources of organic and inorganic matter reach the stream and can be expected to have material effect upon the total loading assimilated. The effect of algae in streams is recognized as having some significance, but there is little information in the literature on these effects. The main questions for which answers were sought by the preliminary experimental work were: 1) What influence, if any, does the presence of algae have on the laboratory BOD determination? 2) What influence, if any, do increasing amounts of algae have on the laboratory BOD value? 3) What difference occurs in oxygen usage rates between samples containing algae which are incubated in the dark and in the light? 4) What influence, if any, does the presence of dead or decomposed algal cells have on the BOD determination? Because of the length of the report, it has been arbitrarily divided into two parts. In Part I, there is set forth the above questions for which answers were sought, the techniques used, results of observations on algae counts are enumerated in several Tables, and the effects of algae as shown in Tables 1 to 5, and Figures 1 and 2. Part II, which will appear in the next issue, will contain data in Table 6 and Figures 3, 4 and 5, as well as pertinent discussion of the results.

"Algae and Their Effects on D.O. and B.O.D. By Theodore F. Wisniewski. *Water and Sewage Works*, June, 1958.

Other Articles

"The Uniflow Tank." Part II of this covers the experimental work on an **improved sedimentation tank,** and presents three diagrams prepared to assist engineers in the design of settling tanks. By James L. Dallas, Water and Sewage Works, June, 1958.

"High-Rate Digestion." In this article the author states the **fundamental concepts of high rate digestion** and discusses loading parameters, **detention** time, limitations, and advantages of the process. By Clair N. Sawyer. Water and Sewage Works, June, 1958.

"Effects of Synthetic Detergents on Sewage Treatment Problems." An appraisal of **the problem of syndets** and how they are likely to affect sewage treatment processing in the years ahead. By Clair N. Sawyer. Sewage and Industrial Wastes, June, 1958.

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Awards for Outstanding Water and Sewage Facilities in Florida

Representatives of some of the twelve Florida cities cited by the State Board of Health recently for outstanding water and sewage plant operation are shown herewith following presentation of awards. They are (seated, from left to right) Harry L. Berkstresser, director of public utilities, Panama City; David B. Lee, director, Bureau of Sanitary Engineering, State Board of Health, Jacksonville, who presented the awards; Leon C. Jackson, Cosme Water Plant, St. Petersburg; Edward T. Jelms, water plant superintendent, Winter Haven; (standing, left to right) Kenneth E. Drautz, chief chemist, City of Miami sewage plant; Cliff Courson, Tampa Sewage Plant; J. L. Burnett, Tampa Water Plant; Perry A. Cessna, superintendent, Water & Sewage Plant, Bradenton; Richard L. Priester, St. Augustine Water Plant; and William H. Case, superintendent, Winter Haven Sewage Plant. The awards were as follows: Panama City—the best operated sewage treatment plant, any class; St. Petersburg—best lime softening water plant, over 25,000 population; Winter Haven—best operated primary treatment water plant, over 10,000 population; Miami—best activated sludge sewage treatment plant, over 10,000 population; Tampa—best operated primary sewage treatment plant, over 10,000 population; Tampa—best coagulation and filtration water plant, over 10,000 population; Bradenton—best trickling filter sewage treatment plant, over 10,000 population; St. Augustine—best lime softening water plant serving between 10,000 and 25,000 population; Winter Haven—best primary sewage treatment

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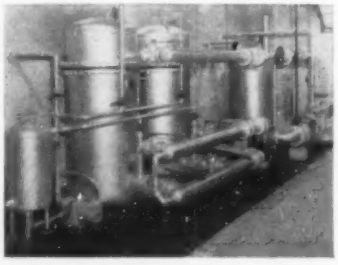

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plant, under 10,000 population; Carol City Subdivision, Dade County—best activated sludge sewage treatment plant serving less than 10,000 population; Homestead—best trickling filter sewage treatment plant serving less than 10,000 population; Atlantic Beach—best primary water treatment plant serving under 10,000 population; Florida State Hospital, Chattahoochee, water plant—best coagulation and filtration water plant serving under 10,000 population; Brentwood Estates Subdivision, Broward County—best lime softening water plant serving under 10,000 population.

• • •

Summer Survey School for High School Graduates

Forty Michigan high school graduates have qualified for an 8-weeks course in surveying at the University of Michigan summer survey school at Camp Davis near Jackson, Wyoming. The school is sponsored jointly by the University's School of Engineering, the Michigan Road Builders' Association and the Michigan State Highway Department.

The group were top qualifiers in a field of 68 students who took a competitive civil service examination. Entrance requirements included completion of trigonometry courses in high school. The summer course at Camp Davis is intended to stimulate interest in highway engineering and to provide future engineers for the Department. It covers the fundamentals of elementary surveying (measurements with a tape, level and transit) and its application to highway surveying. The material covered is equivalent to a course in elementary surveying and about half of a course in route surveying.

Most colleges and universities will accept the work done at Camp Davis as partial credit toward the completion of surveying requirements for a degree in civil engineering.

Students completing the Camp Davis summer course will have the choice of continuing their engineering studies in college, or joining the Department as engineering aides. Those going to college will be given educational leaves by the Department and will have jobs waiting for them next summer providing they take engineering courses in the meantime. Full-time jobs with the Department will be available to those who continue in college and work summers for the Department until graduation.

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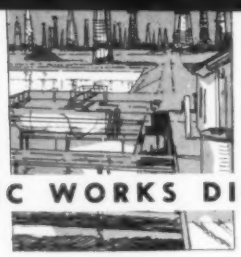


PUBLIC WORKS DIGESTS

Prepared by
CLAYTON H. BILLINGS
Associate Editor

THE INDUSTRIAL WASTE DIGEST

Flotation as a Waste Treatment Measure

Although flotation has been in use for 50 years, it was applied in the mining and paper industry almost exclusively until 1942, and only since that date has its use in waste treatment been developed. As applied in the mining industry, air is admitted either under pressure through diffusers or by mechanical means, with chemical conditioning agents added to the ore slurry to facilitate the inclusion of metallic concentrates with the froth and to permit the useless materials to settle. In waste treatment, chemicals may not be required. The "savealls" of the paper industry involve dissolving air in the white water prior to its admission to the unit. The air is either educted on the suction side of the feed pump or admitted to the discharge side of the pump under pressure. The white water containing air dissolved under pressure is passed through a closed retention tank to permit the release of undissolved air bubbles. From this the waste is admitted to the flotation tank through a control valve. With the pressure drop, air is released from solution, carrying with it to the surface the fibrous suspended matter. Chemicals for floc improvement can be added at several points ahead of the flotation tank. Some flotation units in current use take advantage of the fact that many wastes already contain flocculent matter and consequently introduce the air dissolved in the clarified effluent rather than in the raw wastes to avoid breaking up the floc in pumping. Flotation can also take place under vacuum, with air present under normal pressure. A review of the application of flotation principles to sewage treatment shows that there are but few plants of substantial size with more than a few years of experience. There are, however, a number of locations where consideration is being given to its use in place of sedimentation, for clarification of the mixed liquor from aeration units in activated sludge, and for sludge concentration prior to digestion. In treating industrial wastes, a number of successful installations have been reported, these relating mainly to oil, paper and food processing. Flotation has economic advantages over sedimentation, considering the average detention time of 20 minutes and overflow rates of 2 gpm per sq. ft. and the use of prefabricated and assembled units. Power is an expensive item, and chemical cost must be considered.

"Flotation Treatment of Sewage and Industrial Wastes." By E. Sherman Chase. *Sewage and Industrial Wastes*, June, 1958.

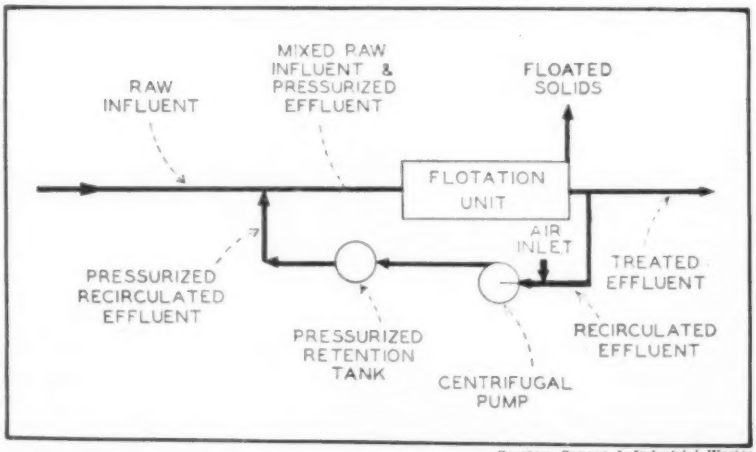
Chemical Waste Disposal at Sea

To overcome air pollution problems at its Deer Park, Texas, plant caused by attempting to burn wastes consisting of chlorinated hydrocarbons, the Shell Chemical Corp. investigated ocean disposal methods. The waste is moved by barge in 1100-ton quantities at the end of a 1200-ft. hawser by a tugboat. After the barge reaches the disposal area, 110 miles south of Galveston, the wastes are pumped overboard into water depths of 200 to 88 fathoms. Samples of water at various depths and of muds were analyzed for organic chloride to determine the degree of dispersion of the wastes, and specimens of marine bacteria and plankton were studied. It was concluded that disposal could be accomplished in this manner with only slight effect on the organisms present. The concentration of the waste can be kept low by a slow pumping rate and by keeping the barge underway at the full speed of the tug. It was found that the disposal area had sufficiently cleared of waste in 6 to 8 hours to near the threshold toxicity level to plants and below the lethal level to animals. To avoid possible contamination of bottom deposits of fishing grounds through slow diffusion at the 50 to 100-meter level, it is believed necessary to begin disposal beyond the 400-fathom line.

"Deep Sea Disposal of Industrial Wastes." By Donald W. Hood, Bernadette Stevenson, and Lela M. Jeffrey, Texas A. and M. College. *Industrial and Engineering Chemistry*, June, 1958.

Bedspreads Beget Syndets

In Dalton, Ga., some 30 textile plants employing 4,000 people are engaged in making chenille bedspreads, robes, bathmats, carpets and toys, much of it by hand. The products require specialized laun-



Courtesy Sewage & Industrial Wastes

● **FLOTATION flow diagram showing effluent pressurization and recirculation.**

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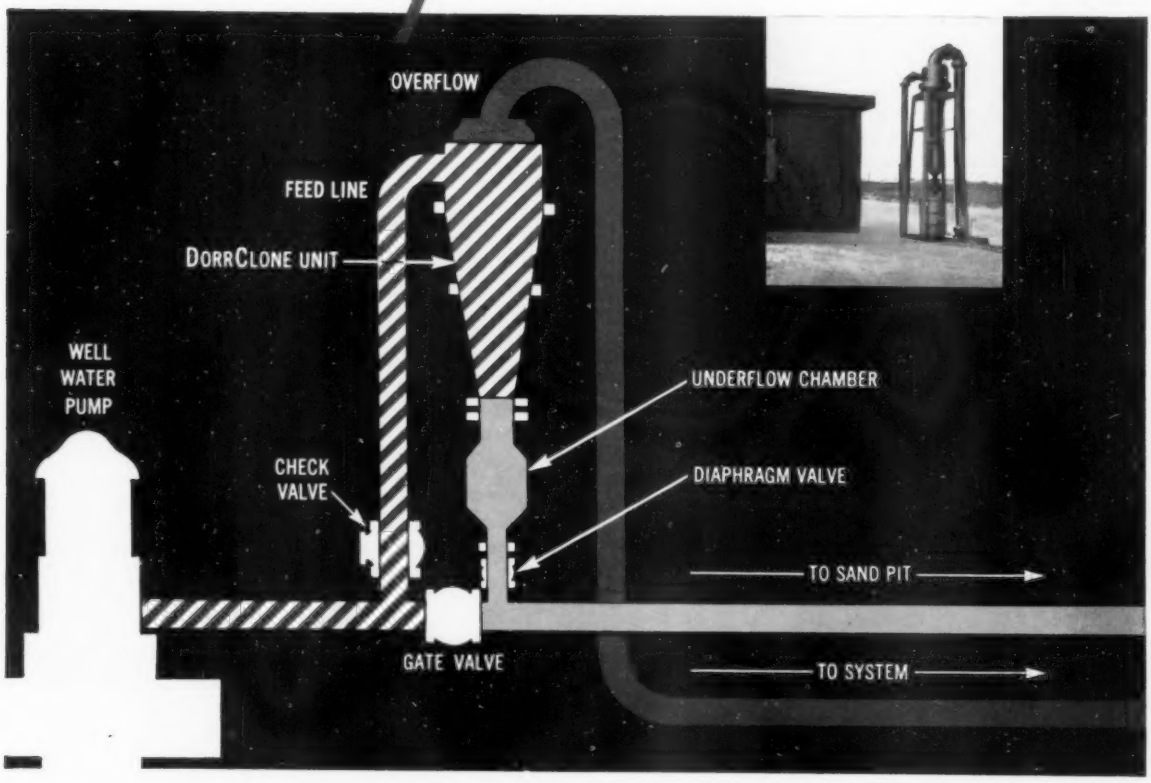

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Heart of the system is in the DorrClone unit, a cylindro-conical shell, shown diagrammatically above. In operation, raw feed water enters tangentially under pressure at the top. A vortex action is created, throwing sand particles to the walls of the cone and down to the underflow at the bottom. Sand-free water at the center of the vortex flows out the top to storage, a treatment plant, or directly to the mains.

The simplicity of the DorrClone desanding system is demonstrated in the installation at Hobbs, New Mexico, shown in the small photo. Units may be designed to suit practically all well water systems. For full information, write for a copy of Bulletin No. 2507.

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dering to prepare them for marketing, resulting in the discharge of a large quantity of synthetic detergents into the city sewer system. The characteristics of the sewage include periodic high concentrations of salt, 2,000 to 3,000 ppm; an odor of chlorine; very little turbidity; and rapidly changing colors. Studies of the efficiency of the primary settling basin of the trickling filter type sewage treatment plant showed that very little BOD removal occurred in this stage and lower than anticipated removal took place in the trickling filter.

"Syndets Kill Settling Efficiency." By Robert S. Ingols. *Wastes Engineering*, June, 1958.

Storm Drainage and Waste Treatment

The General Electric plant at Schenectady produces primarily larger size generators and motors. With the Mohawk River as a source, the industrial water use amounts to 28 mgd. The problem of storm water runoff and waste disposition has been difficult because the location of the works is in a low-elevation drainage basin. With plant expansion and even with attendant addition to existing drainage and sanitary sewers throughout the years, inadequacies were still apparent during heavy rainfalls. A survey was made in 1950 by consultants with the assistance of plant personnel in the interest of developing a long range plan. The study included estimation of storm water flows, which led to the conclusion that the storm water handling capacity would need to be 420 mgd and that for waste processing 33 mgd. With storage in the system amounting to 320,000 cu. ft. and pumping capacity 285 mgd, it appeared that expected flows could be handled satisfactorily. In designing the treatment plant provision was made for bypassing storm water flows around the oil separating facilities. The average waste analysis showed that the concentration of warrant treatment for their removmetallic ions was not sufficient to al. Consequently the treatment resolved itself into removal of grease and oils by flotation and handling associated solids by settling. Bar screens were placed ahead of the pumps and a grit removal system preceded the oil separators. Operation of the separator and analyses of the effluent indicate that the oil load to the river is well below that which would cause trouble.

"Electrical Manufacturing Plant Waste Problems." By F. Horrocks, General Electric Co. *Sewage and Industrial Wastes*, June, 1958.

Dust and Fume Recovery Systems

The engineering design considerations for industrial dust and fume recovery must consider present and proposed ordinances; public and labor relations with regard to plant cleanliness and stack appearance; means of disposal of collected dust; future plant expansion; removal of gases and odors; and removal or reduction of the stack plume. Control measures at the source include changes in the process to reduce dust loss, elimination of source of air infiltration and recycling of dust among other adverse operating conditions. Control equipment considers the engineering problem of collector selection with judicious choice of alternate types. The experiences of electric utility companies with coal burning generator stations illustrate the problem of collected dust disposal. For 25 years, efforts have been made to use fly ash as a concrete additive and considerable amounts have been used, but the unused quantities of fly ash in some metropolitan cen-

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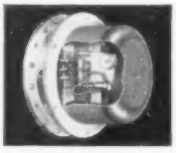

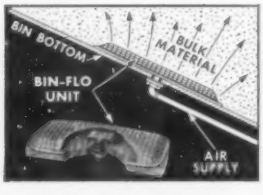

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Clay Pipe for Underdrains

BECAUSE it "gives the *best* resistance to sanitary sewage", more than nine miles of Vitrified Clay Pipe were specified for Sandusky, Michigan's new sewer system and treatment plant. Underdrains of Clay Channel Pipe were installed in the treatment plant sand filters to handle the highly-corrosive wastes encountered in this severe service. Because Vitrified Clay Pipe is the only pipe that is chemically inert, it is the only pipe capable of year-after-year service in filter underdrains. Clay Pipe is not affected by the corrosive action of chemicals and gases found in sewage . . . does not corrode or deteriorate under any conditions.

When your city plans sewer improvements, protect the long-term investment with Vitrified Clay Pipe . . . the only pipe with *all* the features you can trust.

CONSULTING ENGINEERS: Spicer Engineering Company, Saginaw
CONTRACTORS: Taylor Construction Company, Saginaw

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Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D. C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 206 Mark Bldg., Atlanta 3, Georgia

ters is so enormous that it must be pumped or hauled for landfill or barged to sea. A check list is given showing collector applications for various operations of some industries to serve as a guide for equipment selection. It covers the use of dry and wet electrostatic precipitators, baghouses, reverse-jet filters, cyclones, scrubbers, conditioning and cooling chambers and low draft loss mechanical collector fans. Where a single piece of equipment may not give the desired results, the use of several different types in series will.

"Engineering Design Factors in Dust and Fume Recovery Systems." By Richard O'Mara and Carl R. Flodin. *Journal of the Air Pollution Control Association*, May, 1958.

Other Articles

"Chemical Engineering **Aspects of Air Pollution** Control." by Marcus Sittenfield. The comparatively recent recognition of the chemical engineering phases of this problem has resulted in emphasis being placed by the designers of control apparatus on the elimination of smoke and particulate matter from gaseous effluent, but the growing pressure to eliminate all pollutants is a tremendous challenge. Journal of the Air Pollution Control Association, May, 1958.

"Evaluation of **Air-borne Particulates** in Atmospheric Pollution Studies." By Morris Katz, H. P. Sanderson and M. B. Ferguson. A method of measuring hourly variations in concentration for small samples that cannot be assessed gravimetrically was developed. Analytical Chemistry, July, 1958.

"Portable Automatic Alarm for **Detection of Toxic Agents** in Atmosphere." By J. C. Young, J. R. Parsons, and H. E. Reeber. A device for automatically detecting the G series of chemical warfare gases is described. Analytical Chemistry, July, 1958.

"**A Review of the Literature** of 1957 on Sewage, Waste Treatment, and Water Pollution." This second of three sections covers industrial wastes, more specifically: Canning, sugar, dairy, packinghouse, fermentation, chemical, pharmaceutical, coal, coke oven, petroleum processing, pickling, plating, pulp and paper, tannery, textile, wool scouring and radioactive wastes. Sewage and Industrial Wastes, June, 1958.

• • •

Lime Stabilization Movie Available

A new 16 mm. sound-color movie entitled "Lime Stabilization of Roads" is available from the National Lime Association. This 23 minute film shows the use of lime in stabilizing marginal clayey soils on projects ranging from Interstate freeways to farm-to-market roads, and including city streets, airfields and shoulders. Typical construction procedures for both subgrade and base courses are shown. Also shown graphically and by actual field examples is how lime changes soil characteristics, such as lowering of P. I. and shrinkage, increasing strength and stability, and expediting construction during wet weather. For reservations for showing the film write to the National Lime Association, 925 - 15th St., N. W., Washington 5, D. C.

• • •

Article Wins Award

Second prize in the Dravo Corporation Annual Technical Papers Contest was awarded to Frank R. Burde for his article entitled "Sewage Treatment for a Modern Shopping Center," which appeared in the November, 1957, issue of PUBLIC WORKS. Entries submitted in this contest consist of technical papers on subjects related to Dravo products or services. The prizes are cash awards ranging from a $500 first prize to $50 for honorable mentions. Approximately 20 entries are submitted each year.

the process...
Carbonation--Water Treatment

CARBALL
CO2 UNIT

the equipment...
Walker Process CARBALL CO2 UNIT

Four size 4 Carballs at Kansas City, Mo. burn either gas or oil to produce max. of 40,000 lbs. CO_2/day. Size "O" unit at right produces 570 lbs. CO_2/day for Jefferson, Iowa Water Plant.

Walker Process now offers carbonation units for all lime softening plants from the very small to the largest. Sizes range from the new "OO" unit with minimum capacity of 55 lbs. CO_2/day to the No. 4 at maximum output of 10,000 lbs. CO_2/day. Engineers can readily provide an entire carbonation system by simply specifying the appropriate size CARBALL in combination with Walker Process SPARJER diffusers . . . . . assuring

100% Combustion • Economical Operation • Unique Absorption Method
50% More CO_2 • Clean, Tasteless Gas • Factory Tested Package System

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AURORA ILLINOIS

Safety-Conscious Fort Wayne Installs First Fluorescent-Lighted Cloverleaf

To cut down on costly after-dark accidents, safety - conscious Fort Wayne, Ind., has installed 115 fluorescent luminaires to illuminate a heavily-traveled cloverleaf interchange at the intersection of U. S. Routes 24 and 30, Indiana Route 14 and Beuter Road.

Four-lamp, six-foot General Electric units, rated at 23,000 lumens, were selected for lighting the hazardous interchange which is located in the heart of the east end industrial area of the city. Prior to installation of the new luminaires, five traffic accidents—four of them at night—occurred on the cloverleaf. To provide optimum illumination, luminaires were mounted 30 feet above the roadway on aluminum brackets attached to 85 wood poles. Mounting arrangements and distances vary according to changing roadway conditions on the cloverleaf. In some areas, units are mounted two to a pole, while in other areas luminaires are mounted one to a pole. The luminaires extend a distance of about one-half mile on either side of the two main highways. The lighting system—controlled by means of photoelectric cells—requires 58,500 watts for normal operation. Load is supplied by two 37½-kva transformers with a capacity of 75,000 watts.

White fluorescent lamps were selected to provide the closest possible approximation to normal daylight Fixtures have been installed so as to guide traffic through the various turns of the cloverleaf and to provide illumination of guide signs that control the interchange traffic.

• • •

Scholarship Program of NEWWA

Application forms for a scholarship loan or grant can be obtained from NEWWA Scholarship Committee, 73 Tremont St., Boston 8, Mass. The value is about $300, which may be awarded as a loan or grant to a member or junior member.

Street Lighting Program for Philadelphia

The capital improvement program for Philadelphia, Pa., proposes installations of street lighting equipment, including the removal of 8,000 gas lights and modernization of 18,000 out-of-date and inefficient existing lights. The program will bring the total of electric lights to 70,000.

WEMCO® the INCREDIBLE Torque-Flow Pump

pumps almost everything

(what will go in will come out)

secret: recessed impeller; continuous open passage

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Underground Boring Machine

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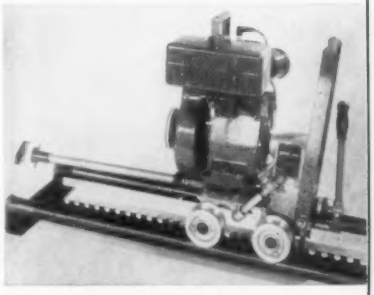

Model 40

- **BORES**—with no surface break
- **BORES**—up to 250 feet in length
- **BORES**—up to six inches diameter
- **BORES**—so drill stem of pipe of conduit stays
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- **REAMS**—up to 12 inches diameter

Write immediately for information.

P. O. Box 1100
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TWO PIECE

sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.

Adjustable VALVE BOXES

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valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Complete line of service and roadway boxes.

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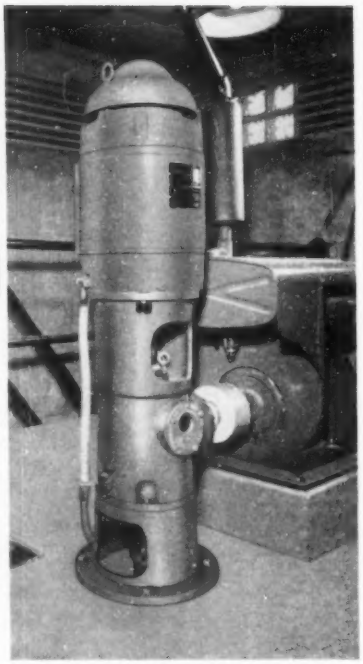
For positive protection
against power failures, install

JOHNSON

Right angle

GEAR DRIVES



Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

Sizes: 15 to 450 hp. Johnson Right Angle Gear Drives are available in combination, dual and standard types; for all horizontal prime movers; hollow or solid shaft. Please write for engineering catalogs.

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FILTER SAND .....any size

UNDER-DRAIN GRAVELS 5 inch & down

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1918 — *40th Anniversary* — 1958

EAU CLAIRE SAND & GRAVEL CO.

Eau Claire, Wisconsin

Training in Sewage Plant Operation

A five-day basic course for sewage treatment works operators will be given at the New England Field Training Station, University of Massachusetts, Amherst, Massachusetts, August 25-29. The course is planned to provide training in the fundamentals of good sewage plant operation and consists of lectures, discussions, laboratory analysis and field work. The course is sponsored by the Division of Sanitary Engineering, Massachusetts Department of Public Health; the University of Massachusetts; and the New England Field Training Station, Communicable Disease Center, U. S. Public Health Service. For applications and registration information contact the Short Course Office, Stockbridge Hall, University of Massachusetts, Amherst, Massachusetts.

National Highway Conference For County Engineers & Officials

The 6th Annual National Highway Conference for County Engineers and Officials will be held at the Concord Hotel, Kiamesha Lake, N. Y., on Sept. 29-30-Oct. 1, 1958. An interesting feature of this meeting will be briefing sessions on modern devices and methods in highway engineering; especially designed for the county engineer. For complete information write Ben Ostergren, Managing Director, County and Local Roads Div., ARBA, World Center Bldg., Washington 6, D. C.

"Chemical Rotation" Method of Odor Control in Sewers

The Cloroben "Chemical Rotation" method, originated by Arnold Haverlee, Technical Director of the Cloroben Chemical Corp., has been developed to eliminate grease and slime and to serve as a preventive measure against the generation of sulfide odors and consequent corrosion damage in sewers.

Recently introduced in Florida, the method has been adopted by major cities on the Florida southeast coast, from Key West to Palm Beach. These cities depend on low gradient sewers and numerous lift and pump stations in their sewage collection systems. Consequently the flow is sluggish and delivery of sewage to the plant is delayed. It is under such difficult conditions that Cloroben has been valuable in controlling odors and suppressing sulfide formation.

Now Available – Crane A.W.W.A. Valves with "Ring-Tite"* and "Fluid-Tite"** Ends

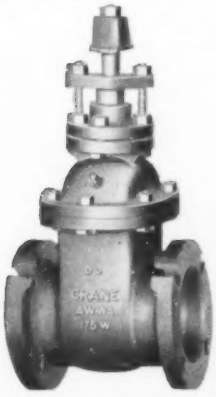
Two new Crane A.W.W.A. valves for use with asbestos-cement pipe —"Ring-Tite" and "Fluid-Tite"—are available in 3, 4, 6, 8, 10 and 12-inch sizes. These valves—added to Crane hub, flanged and mechanical joint end patterns—enable you to specify Crane quality for most A.W.W.A. valve installations.

More Advantages in Crane Quality

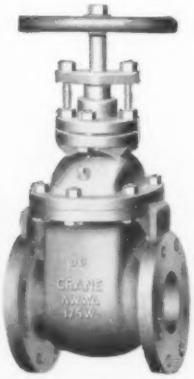
You can put Crane A.W.W.A. valves into service with no question of operating dependability when needed. They're engineered to give long-term trouble-free, maintenance-free service. Here are some of their advantages:

1. **Simple, 4-piece disc assembly and guide rib design—can't jam or become disengaged in service.**
2. **Trunnion-mounted rotating discs move freely . . . prevent wear on disc and seat.**
3. **Positive wedging action seats discs tightly**
4. **Non-binding ball-type gland and gland flange**
5. **Meet A.W.W.A. standard specifications**
6. **All patterns available either bronze-trimmed or with all-bronze internal parts with "Ni-Vee"‡ bronze stems**
7. **Choice of two types of stuffing boxes—with "O" ring seals or conventional packing**

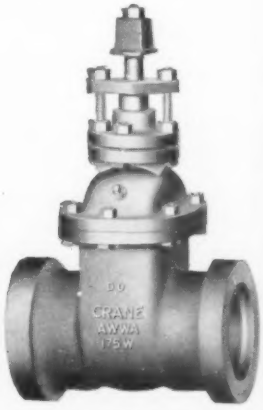
For complete details, ask your Crane Representative for information, or write to the address below.



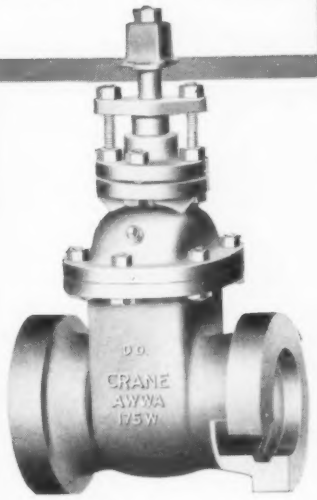
No. 2487½ Mechanical Joint Ends
Sizes†: 2 to 24-inch



No. 2485 Flanged Ends
Sizes†: 2 to 24-inch



No. 480½ Hub Ends
Sizes†: 2 to 24-inch



No. 2482½ "Fluid-Tite" Ends—
Sizes: 3, 4, 6, 8, 10, 12-inch

No. 2482½ "Ring-Tite" Ends—
Sizes: 3, 4, 6, 8, 10, 12-inch

**Johns-Manville Asbestos Pipe*
***Keasbey-Mattison Asbestos Pipe*
† Excludes 5-inch size
‡"Ni-Vee" is a registered trade-mark of the International Nickel Co.

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TRANSPORTATION FOR A SURVEY PARTY

● **THIS all-wheel-drive unit is one of three Travelalls employed in maintaining the $20 million joint city-county flood control system in Sedgwick county, Kansas.**

A SURVEY party of the Wichita-Valley Center Flood Control project runs traverses along an Arkansas river levee using a four-wheel-drive International Travelall as part of its equipment. The Travelall, one of three in use here, serves as cross-country transportation for the crew, work office and equipment carrier all along the route of survey. The four-wheel traction permits survey and maintenance crews to move freely along all of the 100 miles of levees and 50 miles of new channels and numerous drainage structures of the project.

Street Oiling Charges

For some years Eau Claire, Wisc., has charged property owners the entire cost of oiling streets except for intersections. Because of long stretches of streets within the city under individual ownership, there has been some question as to whether the special assessment charges did not exceed the benefits, particularly where the land was used for farming purposes. To formalize and establish a uniform policy on street oiling the council has recently adopted the following:

"The property owner will be assessed the cost of oiling a street on the following per foot frontage basis of continuous ownership: For the first 165 feet, the full rate; for the next 165 feet, two-thirds the full rate; and for any remaining frontage over 330 feet, one-third the full rate. No assessments will be made for oiling of intersections. Alleys will be assessed at half the full rate."

Under this policy, and using the 12¢ per front foot straight oiling rate which prevailed in 1957, 1,000 feet of frontage would pay $59.80 instead of $120.

HALF-SIZE BITUMINOUS PAVER FOR CONSTRUCTION AND REPAIR

A SMALL bituminous paver finisher, about half the size of standard black top paving machines, is operated by Randall Kilmer Construction Company, Port Angeles, Wash. On a 12-mile section of Route 9A, the work involved repairing 100 to 900-foot sections, many of which were separated by distances of 100 feet to 3 miles. There was no need to load the paver on a flat bed trailer for transportation between to-be-repaired roadway sections. According to Mr. Kilmer: "With our Black Top Paver, which carries a truck license, all we had to do to move it to and from the job was remove the 4-ton capacity hopper and extensions to the 8-foot screed, and drive it as a truck at 8 miles per hour travel speed."

More recently the Kilmer firm completed paving a widened and relocated one-mile section on Elwha River Road, 11 miles west of Port Angeles. Asphaltic material—85/100 penetration hot asphalt—was placed in a 2-inch mat on two 10-foot lanes. Crushed rock for the asphalt mix was supplied by Clallam County Road Department. Hot mix was processed at the Kilmer plant, Port Angeles, and then hauled to the job site by county trucks.

Maximum daily production of the Kilmer plant is 350 tons. A total of 1,400 tons of this asphaltic concrete was placed in four days by the Blaw-Knox PF-45 which has a paving speed of 10 to 62 feet per minute. On this job it placed ½ mile per day, single lane.

● **MANEUVERABILITY of this year-old Blaw-Knox Model PF-45 bituminous paver-finsher has permitted its owner, Randall Kilmer Construction Co., Port Angeles, Wash., to cut working time and construction costs and handle a variety of jobs.**

All internal parts, including the drain valve seat, are drawn through the top of the hydrant without disturbing the standpipe.

We can show you – right in your office – why Mathews dry-head construction is so important

No community can afford to take chances with its hydrants. They *have* to work—not just when they're new, but in every single emergency during the course of a long, long life. That's why the dry-head construction of the Mathews Flange Barrel Hydrant is so significant. It keeps sand and ice and sediment from accumulating and interfering with its instantaneous operation, a feature that can be highly important.

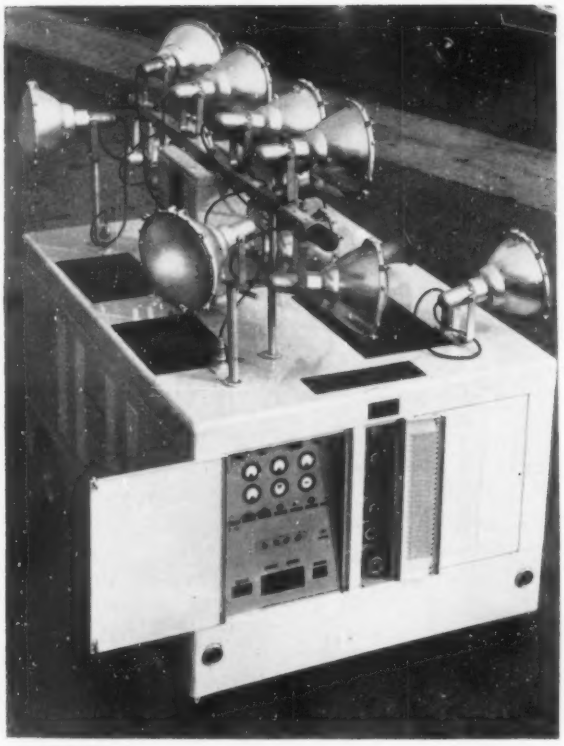
We can actually show you what we mean without even asking you to get up out of your chair. We'll bring our scale model to your office and disassemble it so that you can see its inner workings. Why not write us today and ask for one of our representatives to show you these important features.

Made by

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)



● MOBILE power and light unit similar to one ordered by Los Angeles. Power outlets are at side of instrument panel.

● LIGHT standard is raised and lowered hydraulically and may be rotated through 360° to direct floodlights as needed.

MOBILE LIGHT AND POWER
for
Street Maintenance and Civil Defense

BEN R. PARIS,
Director,
Bureau of Street Maintenance,
Department of Public Works,
Los Angeles, California

A NEW MOBILE power and light unit purchased for the Los Angeles Bureau of Street Maintenance and the Civil Defense and Disaster Corps is expected to facilitate night operations of these groups. The new unit will enable the Bureau of Street Maintenance to perform certain work at night, especially in areas where traffic is heavily congested during the daylight hours. It will supply adequate lighting for cleaning walls of vehicular tunnels, and will be used in the construction of wooden bridges and other projects requiring the use of electric powered tools and saws. It will also be available for civil defense and other work of an emergency nature, such as at locations requiring the removal of earth slides from highways.

The mobile power and light unit was purchased from the Carter Engineering Company in Los Angeles. Delivery is expected on or about August 1, 1958.

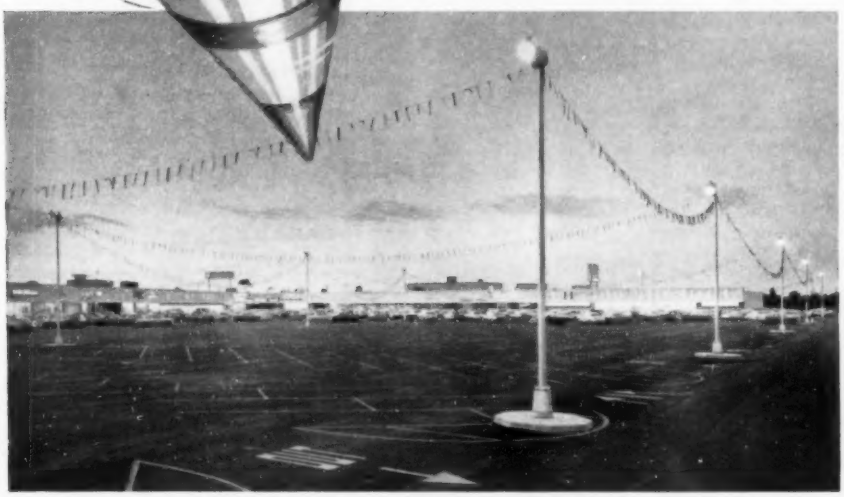
Some of the main features of the specifications are as follows: The generator is a 30-KW, 60-cycle, 3-phase, 110, 220 and 440-volt alternator, with inherent voltage regulation. It is driven by a gasoline engine of not less than 265-cubic inch displacement with a 178 foot pounds continuous torque at 1800 RPM. The unit is trailer mounted with two axles and with four 7.00 x 15, 6-ply tires.

The unit is enclosed with door panels, allowing easy access to the interior. The light standard and 5-stage ram are raised hydraulically and provide a minimum elevation of 20 feet above ground level when fully extended. The light standard will rotate 360° either clockwise or counter-clockwise and is electrically operated. Two structural steel crossarms are mounted on the light standard. There are twelve mercury vapor floodlights, eight to be mounted on the crossarms and four on the body of the trailer. The lamps are color-corrected mercury vapor with approximately 18,000 candle power and with beam intensity of approximately 11,000 lumens.

An outlet panel is mounted beside the control panel with four 110-volt, 20-amp. 3-wire receptacles, and one 220-volt, 50-amp. 4-wire receptacle, 3-phase. The control panel contains oil pressure and water temperature gauges with Murphy switches, engine generator ammeter, fuel indicator, hour meter, frequency meter, volt meter, and ammeters.

Shape IS IMPORTANT TO **BOTH!**

Shape is very important in the design of a top. It must be perfectly balanced to spin properly. In a street lighting standard shape is important, too! Comparison tests show the octagon shape to be 12.2% stronger than the round and 39% stronger than the fluted.



Tyrone Shopping Center, St. Petersburg. One of the largest on Florida's west coast. Eugene Corfar Construction Co. was general contractor and Gabrio Electric Company electrical contractor, both of St. Petersburg.

Approved by leading architects, engineers, contractors and City, County, State and Federal officials, Kerrigan octagon shaped lighting standards are now installed in over 170 cities and towns.

Our new catalogs on steel and aluminum standards tell about the comparison tests and other features you will like. We'll be glad to send them free. Just drop us a line. Address: Dep't. P-8.

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IRON WORKS, Inc.
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the holes do the job!

Keep cellars dry . . . drain wet spots . . . make septic tank filter beds work better

The scientific design of Orangeburg Brand *Perforated* Pipe . . . with two rows of ⅜" holes, on 3" centers, 100 degrees apart . . . increases drainage capacity . . . creates uniform seepage . . . Unique Snap Couplings maintain positive alignment . . . prevent silting . . . Lightweight 8-foot lengths *grade easily, install easily*, save time and cut cost. Orangeburg Perforated comes in 4" size . . . it is the ideal pipe for foundation drains, septic tank disposal fields, land drainage.

Orangeburg *Perforated* Pipe keeps cellars dry. Makes efficient, long lasting foundation footing drains.

Unique Snap Coupling maintains alignment, gives permanent joint cover, permits seepage at joint.

For house sewers, run-offs from downspouts and other tight-joint drainage lines use Orangeburg Brand *Root-Proof* Pipe.

Make sure you get *genuine* Orangeburg. Look for the Brand Name on Pipe and Fittings. For more facts write Dept. PW-88.

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Reservoir Yield Studies

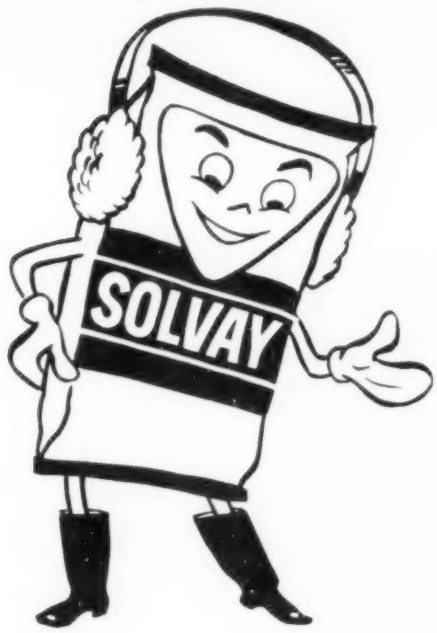
(*Continued from page 92*)

study work: Initial storage + inflow − evaporation loss − use − spills = final storage. The only part of this relation which requires anything more than simple addition and subtraction is the evaluation of the evaporation loss. In the program shown here, this was approximated by the product of the net evaporation for the month (gross evaporation from the lake surface minus effective* rainfall on the lake) multiplied by the area corresponding to the month's initial storage. Areas were derived from initial storage values by the computer through use of the area-capacity polynomial. This gave losses which were somewhat higher than the "true" evaporation, since the initial area was generally more than the average area for a given month. However, the inaccuracy is slight, and this simplification eliminates the need to have the computer find the average areas by trial.

It is immediately apparent that the electronic computer is a means to better engineering. Speaking specifically of yield studies, the computer makes possible several highly desirable analytical approaches which have seldom been used because they were beyond the reach of the manual methods. The integrated operation of multiple-reservoir systems can be solved numerically. A complete account can be made of all water entering a reservoir, whether it is used, spilled or evaporated; which is particularly important in watershed planning. Through correlation with reservoir cost computations, it is possible to show exactly the relation between yield, unit cost and project size. Complete graphical coverage can be developed, which will give answers that are well within the limits of precision for hydrologic analysis problems.

In hydrology, the computer removes what has always been the heaviest burden, that of having to work with mountains of data and volumes of calculations. The limiting factors are no longer time and patience, but an engineer's knowledge and imagination. It is likely that this is happening in the nick of time, for American hydrologists are ceasing to suffer from not hav-

*It is assumed that effective rainfall, as far as offsetting gross evaporation from the lake surface is concerned, should be taken as something less than the total rainfall on the lake, because part of the rain (say 15 percent or 20 percent) is already in the runoff.



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84-88

ing enough data only to realize that it is possible to have too much. Already, there are many promising avenues of hydrologic inquiry which are being left unexplored because they involve superhuman amounts of computation. The computer is the answer—and none too soon.

This material was presented by the author at the 1958 Short School of the Texas Water and Sewage Works Association.

Are YOU Prepared for Winter?

● **FIGHTING one of the frequent heavy snowstorms that hit New York City and its environs last winter, the Department of Sanitation mobilizes modern equipment to clear the streets quickly. This photograph, taken on Fifth Avenue, shows a Trojan tractor shovel with a special snow bucket which loads 2¾ yds. of snow at a pass.**

Winter Maintenance Operations

(*Continued from page* 95)

The four steel storage bins, designed so as to permit gravity loading of spreader trucks, have lent themselves to expediting the operation so necessary to this type of program. Further, by taking advantage of the locations at the rail points, the rail rates, the small cost of unloading into the storage bins, and the negligible cost of unloading into spreader trucks, has saved this Department approximately $11.30 per ton on the approximate 1,000 tons which passed through each bin, when compared with the normal bag deliveries.The extra hopper attached to the undertrack screw proved advantageous when it was impossible to secure the hopper bottom cars at these rail locations and we had to accept box cars.

In the loading and storing of salt at other delivery points, advantage was taken of the tipples and other unloading and storage facilities found in coal and freight yards. Every attempt has been made to store the bulk salt under cover either in bins or sheds. In the instances, however, when outdoor storage was necessary, the sites were carefully chosen, using those

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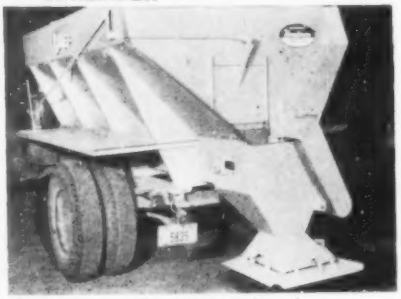

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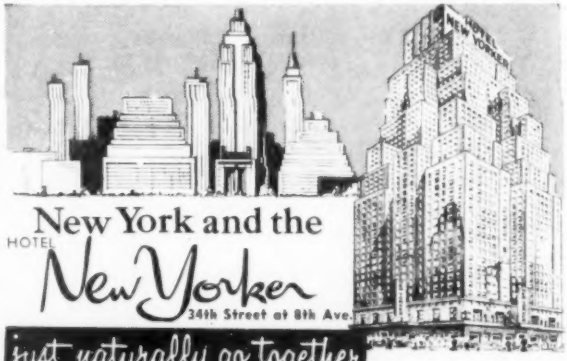

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only where a well-drained paved surface was available. In all instances, tarpaulins were used as cover. We have found this protection prevented the crystallizing of the material and, to us, was worth the cost of this protection.

Each storm varied to the extent that the method of controlling it was different; consequently no set pattern could be established. A too early application of salt would either prove to be unnecessary or would be dispersed by traffic before becoming effective; a too late application resulted in icy surfaces. Consequently, by the trial and error method, we have more or less settled on the following general procedures.

As soon as there is an accumulation of snow on the pavement and the temperature is between 25° and 32° and either rising or falling, we proceed with our salt or treated abrasive trucks over predetermined routes, each truck being assigned approximately 10 miles of single lane highway. Most snowfalls in this area approximate two inches or less in depth. Therefore in many instances the one application of salt has had the desired results in that the snow is dispersed under traffic; or, by plowing we were able to clear the pavement surfaces prior to lowering temperatures. One thing which has been of help to us in these light snows has been the readjusting of our snow plow mold boards to a more perpendicular position so that the blade cuts rather than pushing the shallow depth of snow from the highways. Then again, the position of this blade permits it to clear snow down to the pavement surface since there are no rollers or shoes on mold boards.

Spreading Salt

We have experimented with various rates of application and width of spread of the salt. Our limited experience at the present time leads us to believe that better results are obtained when the material is spread in a four to six-foot width on the crown of the road. Traffic has the tendency to spread this concentrated material, and the crown of the road permits the brine to spread over the entire surfacing. Each storm requires varying quantities of material. Weighing the actual weather conditions at the time of application, plus the forecast, gives our supervisors the cue as to when to start applying and the quantities to be used. Normally, we have found that 600 pounds per mile per 24-foot pavement will suffice for the snows

In North Druid Hills near Atlanta, this Cleveland 95 digs Georgia red clay, often studded with quartz and chunks of granite.

nine Clevelands . . . never a failure in the field

"We have used Clevelands ever since 1946, when our company was organized," says C. V. Lanier, field superintendent for the Concrete Construction Co. of Atlanta, Ga., "and currently we are operating nine. Mechanically, we have never had a Cleveland halt in the field.

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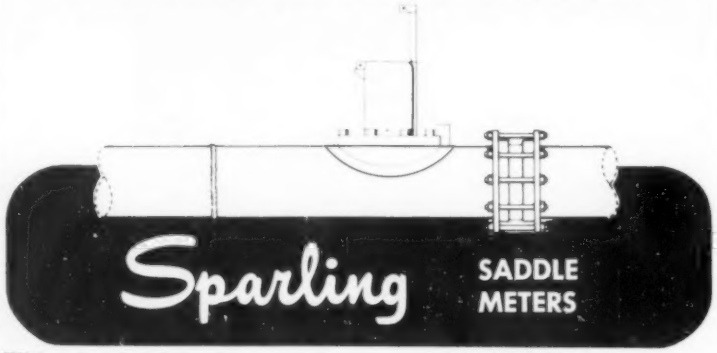

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of from one to two inches. At this depth, plows immediately start and the cycle of plowing and salting is continued until the cessation of the storm and the desired results are obtained.

At this writing we have considerably exceeded our estimated quantities of salt, calcium chloride and abrasives. The estimated 8,000 tons of sodium chloride will be exceeded by approximately 100 percent. Our most western District alone used approximately 12,000 yards of abrasives which equals in quantity, three 80-car trains which had to be unloaded, hauled to stockpiles, treated, loaded again and spread. As a result of the unusually large quantities of abrasives, our calcium chloride, normally used to treat these abrasives, has considerably increased. In addition, for the first time, calcium chloride has been used with good results, as an ad-mixture with the sodium chloride when applied at lower temperatures.

Our maintenance expenditures for the two phases of our winter maintenance, snow removal and ice control, will run approximately 100 percent higher than our normal year. Latest figures indicate that the expenditure for the 1957-1958 season totaled $1,541,052.58, which may be broken down as follows: Labor, 504,645 hours at a cost of $777,154.15; equipment, 107,525 hours at a cost of $268,813.33; and materials costing $495,085.10.

While the cost of this bare pavement maintenance may be high, it pays big dividends to the highway departments in the creation of better relations with the traveling public to say nothing of the personal satisfaction of perhaps saving life, limb or property damage.

• • •

Unusual Bar Screens for Institutional Sewage Treatment Plant

In the sewage treatment plant servicing the Institution for Defective Delinquents in Luzerne Co., Pa., double bar screens are provided ahead of the comminutor. The first screen has bars spaced with unusually wide openings; the second screen has normal spacing. In an institution of this type, towels, sheets, overalls and other materials are frequently thrown into the sewer system by inmates.

The plant, which is designed for 2,000 people, also includes sedimentation and a standard rate filter in addition to digestion and glass-covered sludge drying beds.

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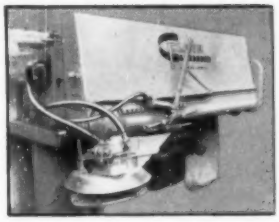
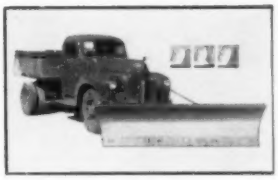
FLINK SPREADERS



For Fast Efficient Ice Control. New model illustrated spreads from left side only . . . saves material and gives better pattern. Also choose from many other hydraulic, cab-operated spreaders; PTO or engine driven hopper types; or the low cost pull-type spreader.

Baker-Flink SNOW PLOWS



For Safe, High Speed Snow Removal. Reversible and one-way plows for 1½ to 5 ton trucks and up. Hydraulic power lift controls to meet your specifications. Underframe or front push models.

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The Penndrill Model "E" is a complete drilling unit, easily operated by one man and drills holes from 1 to 14 inches in diameter up to 19 inches deep—drills vertically, horizontally or at any angle.

Model "E" has been used over a long period of years by Testing Laboratories, State and Government agencies to drill test cores for highways, streets, roads, airports, etc.

Using diamond bits, it removes neat, clean cores from brick, concrete and asphalt paving, including any steel re-enforcing bars that might be encountered.

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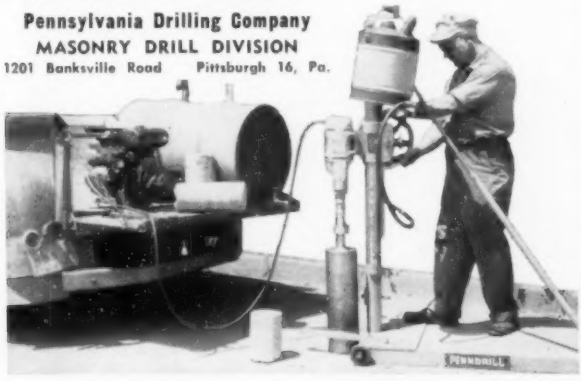

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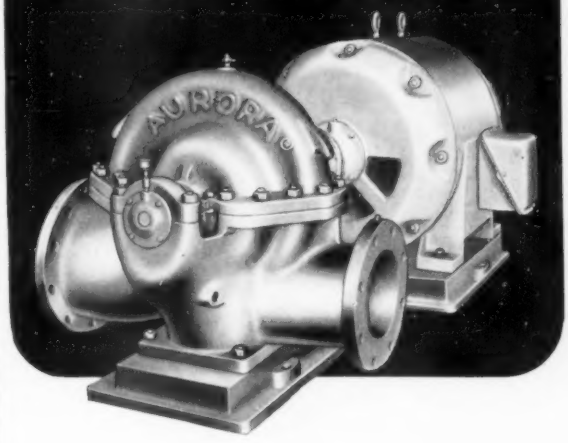

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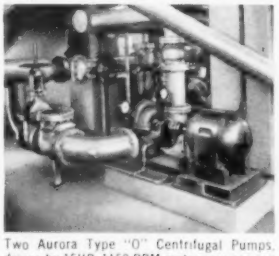

Two Aurora Type "O" Centrifugal Pumps, driven by 15HP, 1150 RPM motors are serving as cooling tower pumps in the plant of C. Schmidt & Sons, Inc., Brewers, Philadelphia, Pennsylvania.

Two Aurora Type "O" Condensation Water Pumps are installed in the Hillsborough County Courthouse, Tampa, Florida. Duty, 1400 GPM against 50' TDH at 1750 RPM.

Whether municipality or industry, you want a pump built for long, maintenance-free life. Equally important, when maintenance *is* needed, you want lines back in service fast!

These Aurora Type OJ centrifugal pumps are built for rugged service, and can be quickly maintained without disturbing suction or discharge piping or pump-motor-base alignment.

They are ideal for municipal or industrial water service for line pressure build-up, boosting to pressure tanks or elevated tanks, cooling tower service, fuel transfer, fire pumps, marine service, circulating, boiler feed service and many other general applications.

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New F.C.C. Ruling Eases MUNICIPAL RADIO PROBLEMS

Local Government Radio Service permits all departments of a governmental entity to use radio under a single license

A RECENT ruling by the Federal Communications Commission effected a new radio service which will do much to ease radio communications problems of public works and other municipal departments. The newly established service is called the Local Government Radio Service. Under its provisions, any governmental entity — village, city, township, county, state or other governmental subdivision — can be licensed to use radio for all of its operations under a single license.

Police, fire, streets, sanitation, parks, utilities, public health and any other department may now share a single base station and dispatcher. (Multiple dispatchers from various places are also permitted.) The radio system is licensed to the city, not a specific department, and so its use is not limited to any one specific function.

Previously, two-way radio systems were licensed separately to police, fire, streets, parks and utilities departments for use only within the specific department. In some cases police and fire were combined into a single system and sometimes emergency vehicles of other departments which had to retain contact with the police were also allowed to use equipment licensed to the police department.

How Cities Will Benefit

For the smaller city, the new service permits a single radio system to be installed to take maximum advantage of the economical and operational benefits of this modern means of communications. As needs grow, the higher priority users, such as police and fire departments, can move to their own channels in a logical economical growth pattern.

The larger cities may now use two-way radio in departments which could not previously be licensed in recognized eligibility groups. This enables local governments to take advantage of radio dispatching techniques used very profitably by private industry.

Certain technical devices will probably be in order on Local Government radio systems used by more than one department so that vehicles hear only that traffic pertinent to their activities. For example, to eliminate the nuisance of having the park field men having to listen to radio traffic originating in street, sanitation and other departments, the entire system could be made selective with such equipment as Motorola "Quik Call" signaling devices. Mobile units equipped with "Quik Call" devices remain silent until signaled to open by the transmission of a tone code from the base station console. Each unit or group of units responds to a particular code. It ignores all others. The code is sent by the mere touch of a button.

The new F.C.C. ruling immediately provides 15 exclusive channels in the 45-46 MC. band and 38 shared channels in the 450-460 MC. band for the new service. Forty-seven additional exclusive frequencies in the 152-160 MC. band are allocated but not yet released for use as of June 20, 1958. This spectrum space is being made available through channel splitting techniques now being put into effect.

Additional information of specific applications of the new Local Government Service can be obtained by contacting a radio equipment manufacturer or its field representatives. These data were furnished us by Motorola Inc.

● **UNDER the new ruling, more municipal departments can take advantage of modern radio communications. In a typical installation, this Motorola remote control console at the water plant is connected through wire lines to the central base station.**

Why progressive cities are expanding water systems with *permanent*

CAST IRON PIPE

LAST year and this, many municipalities began or completed large-scale expansions of their water systems.

Officials of these cities took into account these factors:

- Accelerating urban population growth.
- Increasing daily per capita water use, which jumped from 95 gallons in 1890 to 138 in 1950, 145 in 1955 and is expected to reach 175 gallons by 1975.
- Trend to suburban living, which is adding to the need for expanded water systems in smaller communities and for new systems in newly-developed areas.
- Increasing water needs of industries.

A big majority of all communities that expanded water systems wisely specified *permanent* CAST IRON PIPE — which will give more than a century of trouble-free service and has been rightly called "America's No. 1 Tax Saver."

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Since 1882

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MUNICIPAL DIESEL PLANT EXTENDED TO PROVIDE BETTER SERVICE

AN EXPANSION program that more than tripled the generating capacity of the municipal electric plant has enabled the City of Cushing, Oklahoma, virtually to eliminate purchased power and to reduce power costs more than 33 percent. A major part of the program was the construction of a plant addition to house two new 3500-hp Fairbanks-Morse dual fuel engines.

In many ways, Cushing is ideally located for successful power plant operation. This is oil and gas territory and the City has been called the "pipe line center of the world." The pipe lines are so numerous that one company running a new line had to go over or under 259 others. The industry is an important customer of the municipal electric system which supplies a refinery, six oil and gas companies, nine oil well servicing companies and four drillers. The refinery demand alone runs between 1600 and 1800 kilowatts. In addition, there are several small meat packing plants and a prosperous retail business district. Finally, the population of 12,000 keeps increasing its use of electric appliances, particularly air conditioning.

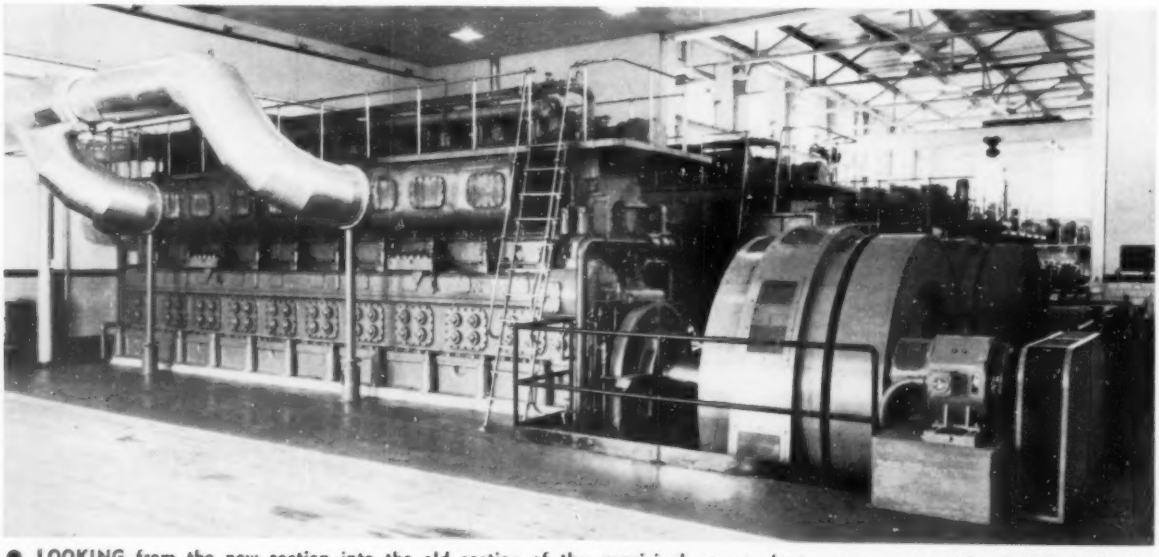
To meet the growing demand, the Cushing plant has expanded steadily since installing its first three 750-hp. McIntosh & Seymour diesels in 1935. Also still in operation are an 1170-hp. McIntosh & Seymour installed in 1939 and a 1420-hp. Fulton installed in 1948. The first four were originally oil-burning engines but were converted to dual-fuel operation.

In the fiscal year ended June 30, 1956, the diesels turned out 12,119,160 kw. hrs. and an additional 12,222,000 kw. hrs. were purchased. It was decided to expand the plant sufficiently to eliminate dependence on purchased power although this meant actually tripling capacity. Into the old section of the plant went a 16-cyl. turbocharged Cooper-Bessemer dual-fuel rated at 3560 hp. at 327 rpm and driving a 2500-kw. EM generator. Biggest part of the expansion program was construction of a new plant addition and installation of two identical Fairbanks-Morse dual-fuel engines. Each of these diesels has 10 cylinders, 18-in. bore and 27-in. stroke, and is rated at 3500 hp. at 277 rpm. Each drives a 2500-kw. Fairbanks-Morse alternator.

Power purchases were reduced to 2,044,200 kw. hrs. at an average cost of 6.49 mills per kw. hr. Plant production rose to an impressive 28,326,900 kw. hrs. and total generating costs (again including labor, fuel, lube, maintenance, supplies and insurance) were cut to 4.40 mills per wk. hr., a reduction of 41 percent compared with the plant's previous year. In the 1955-56 year, Cushing paid a total of $165,799.08 for 24,341,160 kw. hrs., an average of 6.81 mills per kw. hr. In 1956-57, with the new engines carrying the bulk of the load, the city paid $138,943.46 for 30,368,100 kw. hrs., or 4.54 mills per kw. hr. Thus, Cushing got 6,026,940 kw. hrs. more power for $27,755.62 less money.

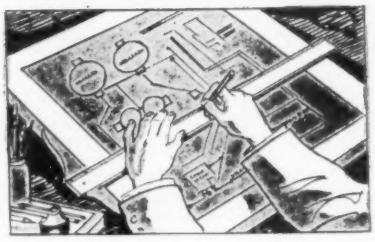
Income for the year was $689,924 and expenses were $207,596. The net operation gain was $482,327, and of this amount, $48,400 was paid for interest and $192,723 to retire bonds; $115,570 was turned over to the city's General Fund. Income from the light plant and the water system pays all expenses of government and municipal services.

C. H. Gurnsey & Co. are the engineers responsible for the design of this plant and the Hoke Construction Co. was the contractor. The project was carried out under the auspices of the city commissioners: Claude C. Wylie, Chairman; Hugh R. Hughes, Vice Chairman; Gene N. Hancock, W. L. Kline, and Leonard C. Blood. L. L. Houston is City Manager.



● **LOOKING from the new section into the old section of the municipal power plant one can see eight dual-fuel diesels.**

CONSULTING ENGINEERS



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Interchange Illumination

Approaching a complex interchange, a driver is confronted with several decisions as to speed, lane, direction and the like. According to H. A. Friede, Chairman of the Committee on Highway Lighting of the ARBA, "90 percent of the decisions and actions of drivers are based on what they see." For that reason, he says, "fixed lighting systems are a necessity on modern, high-speed highways in areas of driver decision such as interchanges, intersections, tunnels and underpasses, bridges and viaducts, access lanes and heavily-traveled urban areas." He backs up his belief with these three key points concerning night driving: (1) Visual efficiency of all drivers is lower at night; (2) The older the driver, the more acute the problem of distinguishing objects at night. For example, the average 55-year old person with 20/20 vision needs twice the light needed by a 20-year old with the same vision; (3) As traffic speeds increase, the eye sees less when it needs to see more at a greater distance in order to provide for safe driving. At 50 miles per hour a person sees 14 percent.

• • •

"Ten Commandments"

(*Continued from page* 110)

main power pumping unit to be out of service; auxiliary power pumping units to take care of average water use; a stand-by well and pumping facilities; elevated storage that will supply limited direct supply to the distribution system if power service is interrupted; and duplicate sterilization equipment.

Estimated Project Cost

The estimated project cost for additions or for a new water works should include the cost of construction and contingencies; land and right-of-ways; engineering inspection, legal, administrative and other overhead, and interest on the financial charges during construction. With rapidly rising construction costs it is also wise to include 5 to 10 percent for increased future costs before contracts are awarded for construction.

Some suggested approximate percentages to include in the estimated project cost include 5 to 10 percent for construction contingencies and 12 to 15 percent for overhead. The interest during construction will be approximately for one year for moderate sized projects and two years for large sized projects.

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Financing

Financing may be considered by some to be outside of the engineering field. However, the consulting engineer usually is required to give advice on financing. Most projects are financed by general obligation bonds, water revenue bonds, and sometimes by special assessment bonds. Occasionally a water works has accumulated the money for water works additions of a small or moderate size, but seldom is there enough for a major addition or a new water works. It is advisable to seek the early counsel and advice of a financial organization specializing in various type of bonds.

Among the factors to consider in financing a water supply project is the question: Are there state statutes that authorize, and do the bonding limits permit, general obligation bonds for all or part of the project cost? If there are, what are the advantages and disadvantages of general obligation bonds? Such bonds are usually from one-half to one percent lower in interest rates than water revenue or other type of bonds. General obligation bonds usually require a referendum.

Most states have statutes authorizing the issuance of water revenue bonds. To municipalities with a good credit rating, such bonds are often attractive. Several of the state statutes permit water revenue bonds to be issued for a longer period than general obligation bonds; for example, for 40 years instead of 20 years. With water revenue bonds the bond companies require a coverage factor of 30 to 50 percent of the annual interest and amortization charges. If the interest and amortization is paid when due, this amount, deposited in the "coverage factor," can be invested by the owner. However, in establishing the water rates, sufficient income is required to provide for this coverage factor. This usually makes the financial charges in the rate base 30 to 50 percent higher than required for general obligation bonds. After this coverage factor has been deposited, and not required for several years, it is often permissible to use any excess for water works betterments or additions.

Water revenue bonds usually require a referendum only if 10 to 20 percent of the voters sign a petition for a referendum.

The shorter the bond period, the less is the total amount paid for interest and amortization. For example, with equal annual payments for interest and amortization for the life of the bonds and assuming 4

percent interest on a $1,000,000 bond issue, the total payment would be 63.8 percent greater for a 40-year bond issue than for a 10-year bond issue.

Rates and Records

Adequate and well balanced water rates are desirable. The practice of having the water income carry part of some other municipal functions, or the use of lower water rates as political propaganda are both undesirable. Privately owned water works often have better balanced water rates than municipally owned systems. Approximately 95 percent of the water works in the United States are municipally owned and operated. Practically all privately owned plants have some charge for fire protection, while only about 40 percent of the municipally owned water works have such charges.

Records of size and location of water facilities, especially those that are not accessible are valuable. These and comparative annual operation records should be preserved with care.

The satisfaction and reliability of future forecasts for design are much better for water supply systems where complete records have been kept and which have been operated and expanded in accordance with these important principles. There is no substitute for basing design decisions on facts.

• • •

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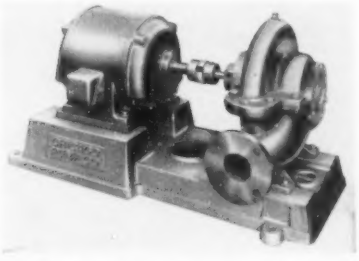
Denison Core Barrel For Soil Sampling

The Denison core barrel, available from the Acker Drill Co., has the ability to obtain undisturbed soil samples from sand, hard clays, silt and other difficult cohesive soil conditions. In operation the core barrel is rotated into the soil either in a cased hole or a hole stabilized with drilling mud. The inner barrel is a full swivel type mounted on anti-friction bearings. As the unit is forced downward with gradually increased pressure, the sample passes through the core retainer into the inner barrel and its thin wall liner. The thin wall liner serves as a permanent container for the sample. For more data write the Acker Drill Co., Inc., Box 830, Scranton 2, Pa., or circle **No. 8-1** on the reply card.

New Line of Horizontally Split-Case Pumps

Chicago Pump Co. announces a new line of horizontally split-case single stage, centrifugal pumps. Known as Type S, features include extremely quiet operation, short and compact overall dimensions, prelubricated bearings and ceramic mechanical seals eliminating stuffing box drip and piping to the drain. The pumps include every latest engineering advancement to insure modern hydraulic and mechanical design and are suited for pneumatic water systems and for boosters in increasing city water pressure. For complete details write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., or circle **No. 8-2** on the reply card.



Pumps for increasing water pressures

Power Take-Off Rotary Air Compressor

Worthington truck-mounted air compressor is ideal for Sewer and Water Depts.

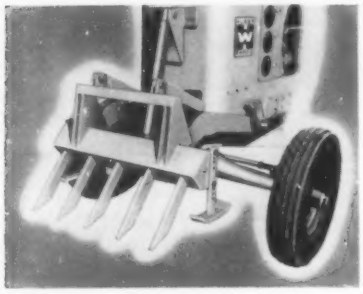
A truck-mounted power take-off rotary air compressor has been announced by Worthington. Featuring comparatively light weight and low space requirements, the self-contained unit weighs 950 pounds, and is only 38 ins. long, 28 ins. wide and 39 ins. high. The power take-off unit is belt driven and completely controlled from the cab. Its variable capacity control allows it to maintain a consistent delivery of 125 cfm at a pressure of 100 psi. The complete unit includes a two-stage, oil-cooled rotary air compressor, speed control, engine governor, oil cooler, air storage tank, oil separator and storage receiver, all mounted on a common base. The new power take-off unit can be readily mounted on tractors, trucks, and jeeps. A demonstration utility truck equipped with the compressor and several of Worthington's air tools is touring the United States for the purpose of acquainting city water and sewer departments with the application of the unit. The tour started in Newark, N. J., and will be completed on the West Coast in October. For information on the compressor or for the dates the demonstration unit will be in your area, write the Worthington Corp., Harrison, N. J., or circle **No. 8-3** on the reply card.

Snow Thrower By Jari Products

The new Jari Sno-Thro machine will handle up to 300 shovelsful of snow per minute and cut a 16-in. path through a foot-deep snow without clogging or stalling. Powered by a four-cycle, 2-hp Briggs & Stratton engine the machine has a special raker bar, mounted on the rotary fan that cuts up packed or crusted snow. Thrown snow is spread over a 20-ft. strip to prevent big banks, and an adjustable deflector instantly changes the throwing angle. Easy to push, it is mounted on two 8-in. wheels with solid rubber tires. A small steel guide wheel in front provides three-wheel suspension and is adjustable to insure maximum snow removal on all surfaces. For more data write Jari Products Inc., 2990 Pillsbury Ave., South, Minneapolis 8, Minn., or circle **No. 8-4** on the reply card.

Snow thrower has a special raker bar that breaks up packed or crusted snow

Scarifier Attachment For Huber-Warco Maintainer



Unit for scarifying roadway materials

A completely new five tooth scarifier attachment for the Huber-Warco maintainer has been engineered for efficient medium and light-duty scarifying of blacktop, stone, gravel, dirt and other materials. It has a swath width of 33 inches and a scarifier pressure of 2400 lbs. It can be quickly attached to the same hydraulic-controlled lifting unit as the bulldozer and snow plow attachments. The maintainer can also be equipped with hydraulic-controlled attachments for service as a bulldozer, broom, side dozer, lift loader, snow plow, patch roller and berm leveler. For more information write Huber-Warco Co., Marion, Ohio, or circle **No. 8-5** on the reply card.

Loader-Backhoe Unit

Two new loader and backhoe combinations for Minneapolis-Moline 335 and 445 industrial tractors have been announced. Designated as the L-3 and L-4 Wheeloaders, the units are presented as fast, quick-detachable, and easy to operate for excavating, trenching, loading and backfill work. The L-3 Wheeloader has 47 bhp; the L-4 has 57 bhp. Capacity of the loader bucket on the L-3 is ½-yard; on the L-4 it is ⅝-yard. On both models lifting capacity is 2,000 lbs.; lift height is 10 ft. 7 ins.; dumping height is 8 ft.; and breakout force is 3,500 lbs. An important feature is that the operator faces his work throughout the 190° arc, when operating the backhoe. On both L-3 and L-4 backhoes, digging depth is 12 ft. 6 ins. Reach is 19 ft. 1 in. from the rear axle, and 15 ft. 6 ins. from the swing post axis. Swing radius continuous is 190°. Dump height is 8 ft. 6 ins. and transport height is 11 ft. Bucket widths range from 14 ins. to 36 ins. For more details write Minneapolis-Moline Co., P. O. Box 1050, Minneapolis 40, Minn., or circle **No. 8-6** on the reply card.

Dual Parking Meter For Low Maintenance and Operating Costs

A new manual parking meter engineered for low maintenance and operating costs has been introduced by the Dual Parking Meter Co. The new permanent adjustment coin handling mechanism, which is entirely riveted, greatly improves meter every time minor maintenance is performed. The new meter will take pennies, nickels, dimes, quarters and tokens through a single slot preventing the motorist from

Meter takes coins through single slot

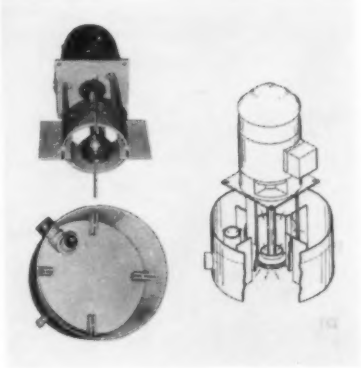
putting a coin in the wrong slot and losing both time and coin. The character of the coin determines the amount of time. A pickup pawl measures the coin diameter and engages the flag at the proper time. For further information write The Dual Parking Meter Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., or circle **No. 8-7** on the reply card.

Euclid Announces New Series TC-12 Crawler

Major improvements in the Model TC-12 crawler tractor have been announced by Euclid. This "Twin" Crawler features 402 hp delivered to the power train, two Torqmatic Drives with independent planetary track drives, no steering clutches, 8 roller track frames, rear mounted cooling system, in-seat starting, fully automatic hydraulic track recoil adjustment and unitized assemblies. As a result of heavier construction and more rugged components throughout, the bare weight of the tractor has been increased from 64,000 to 67,000 pounds plus. Transmission and drive modifications provide longer life and simplified servicing through more effective lubrication, improved wearing surfaces and readily accessible location of key components. Detailed specifications from Euclid Division, General Motors Corp., Cleveland 17, O., or circle **No. 8-8** on the reply card.

Amwell Tank Mixer For Dry Materials and Liquids

A new Amwell tank mixer for mixing dry materials with liquid is announced by American Well Works. The mixer uses a high-shear impeller with controlled recirculating mixing to disperse or dissolve a wide variety of highly cohesive solids in liquids. Positive flow impeller design and high shaft speeds (3500 rpm) develop the high shear without the disadvantage of close mechanical clearances. It can be furnished in single or multiple stages to accommodate a wide range of solid and liquid rates. Turn-over rate and impeller speed can be reduced for blending of liquids or of liquids and readily dispersed or dissolved solids. It can be furnished with or without a mixing tank for continuous or batch mixing. The impeller rotates within a baffled draft tube. Feed materials are drawn down into the impeller suction eye and instantly dispersed and recirculated. For further information, write to The American Well Works, Aurora, Ill., or circle **No. 8-9** on the reply card.



Unit mixes dry materials with liquids

Overhead Electric Hoist

Hoist operates from truck battery and will lift 1000 lbs.

The Model 52-H overhead electric hoist operated from a 6-12 volt DC truck battery is available from Burtchaell Heating Co. The unit has a 1000 lb. lifting capacity and the frame supporting the "I" beam is designed so the beam can be moved forward and securely fastened over the cab. When loading and unloading the beam slides out over the rear of the truck to provide a clear vertical lift. Additional information is available from Hoist Division, Burtchaell Heating Co., 2944 S. E. Powell, Portland 2, Oregon, or circle **No. 8-10** on the reply card.

Industrial Wheel Tractors

A complete new line of industrial wheel tractors has been announced by The Oliver Corp. Six models constitute the basic line which ranges from the Models 550, available with either gas or diesel engine, to the big 995 GN Lugmatic diesel with automatic torque converter, heaviest and most powerful wheel tractor produced by Oliver. Other members of the new line are the 770, 880, 990 GM diesel, and the 950. All except the 990 and 995 are available with gasoline or diesel power. The new tractors mount a wide range of equipment, and have been engineered to incorporate the most advanced features. For complete information write The Oliver Corp., 400 West Madison St., Chicago 6, Ill., or circle **No. 8-11.**

Allis-Chalmers Tractors

Utility tractors feature ease of mounting and dismounting

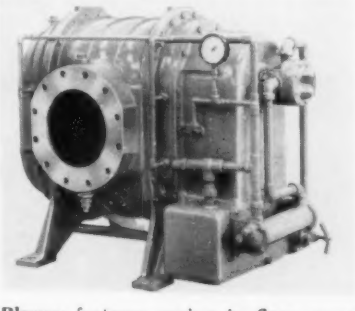
The Allis-Chalmers Model D-14 and Model D-17 utility tractors have a complete line of attachments. The D-14 has 35.65 hp, weighs approximately 4,200 lbs., without equipment and has an overall tractor length of 129 in. The D-17 has 54.43 hp, weighs approximately 5,300 lbs., without equipment and has an overall tractor length of 140 in. Both tractors feature low-line, high-clearance design that provides a low center of gravity for stability and extra high axle clearance. Power-Shift rear wheels and Roll-Shift front axle permit changing wheel widths quickly and safely without the use of jacks or blocks. For more details write Tractor Group, Allis-Chalmers Mfg. Co., Milwaukee, Wis., or circle **No. 8-13** on the reply card.

Completely Miniaturized Wilkinson Line Locator

A radically new, advanced design in electronic locators for determining the precise location and depth of all subsurface mains, services, transmission lines, valves, boxes and cables has been announced by Wilkinson Products Co. True miniaturization is achieved by the use of transistors, subminiature components and etched circuitry, together with original and unique type antennas. This new model is encased in a molded glass fibre container which provides full protection for rough field use. The leak proof mercury cells have a use life of at least ten times ordinary batteries; the transistors have a rated use life of 70,000 hours. For complete details write Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif., or circle **No. 8-12** on the reply card.

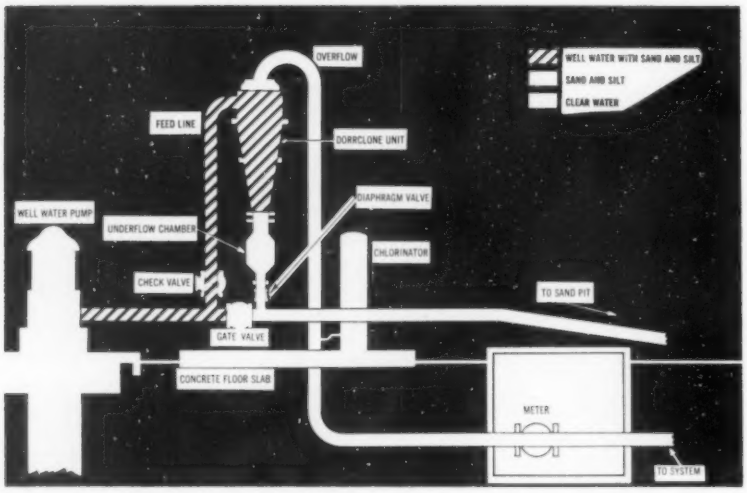
Roots-Connersville Introduces New Design For Blowers And Gas Pumps

A completely new blower, utilizing the Roots rotary positive principle, has been developed by Roots-Connersville. The new blower features a vertical arrangement of the impellers providing horizontal inlet and discharge connections for more convenient piping. An improved segmented waist impeller shape permits safe handling of entrained liquids with an additional advantage of more quiet operation. All units are sized for direct connection to moderate and high speed motors, but V-belt drives may be used for intermediate ratings up to approximately 200 hp. Speeds are matched to economical gas or diesel engine speeds; steam turbine drives can be used with standard speed reducers. Both blowers, designated Type RAS, and gas pumps, designated Type RGS, have identical volume and pressure ratings; 36 selected sizes cover a capacity range of from 2,000 to 14,000 cfm at 6 psig and from 1,500 to 8,000 cfm at 10 psig. For specifications and complete technical information write to Roots-Connersville Blower, 900 W. Mount Street, Connersville, Ind., or circle **No. 8-14** on the reply card.



Blower features saving in floor space

New System Eliminates Sand From Water Supplies

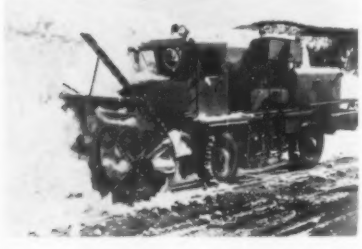


Arrangement of Dorrclone desanding system with positive pressure on the overflow

Dorr-Oliver announces the availability of the DorrClone desanding system for the removal of sand from water supplies. This new system provides a method of continuously eliminating highly abrasive fine sand and silt from distribution mains and their components. The complete system comprises a DorrClone classifier with attached underflow chamber and attendant piping and supports. The DorrClone unit, in which sand removal is effected, is a wet cyclone, rubber lined and cylindro-conical in shape. In all units the rubber lining is replaceable and depending upon cyclone size, the liner may be either molded exactly to the shape of the body or vulcanized in place. Choice of the size of the cyclone, available in diameters of 6, 12 or 24 inches, depends primarily upon capacity requirements and flow variations. Major advantage is the removal of plus 200-mesh sands, those that have been found to do the most damage in distribution systems. As a result, abrasion and plugging of meters and household appliances can be virtually eliminated as can sanding of water mains. Further information is available from Dorr-Oliver Inc., Havemeyer Lane, Stamford, Conn., or circle **No. 8-15** on the reply card today.

Rotary Snow Plow

A new full-rotary snow plow is announced by Edward F. Taylor Co. The plow called Snowblast, involves the use of the Rolba System. The unit is a four-wheel drive, four-wheel steer, full-rotary snow plow, capable of removing 2,000 tons of snow per hour in 8½-ft. swaths, and in depths of 7 feet or more. A Caterpillar Model D337 engine furnishes 200 net hp to the plow power train at an elevation of 10,000 feet. The plow carrier is a Coleman truck powered by a Cummins 180-hp diesel engine to a torque converter and a 5-speed transmission; and can be combined with two lower ranges to a total effective reduction of 950 to 1. Write the Edward F. Taylor Co., Denver, Colorado, or circle **No. 8-16.**



Rotary plow handles difficult drifts

Cutter Mows a Clean Swath

The Danco Model TM rotary cutter meets most specifications for mowing along streets and highways. Safety features include heavy safety chains mounted on the front and back of the mower to prevent materials other than grass from being ejected. Available in tractor or mounted models, the unit will cut a 5-ft. swath. Write Danuser Machine Works, Inc., Box 5095, 2525 So. Sheridan Road, Tulsa, Okla., or circle **No. 8-25** on reply card.

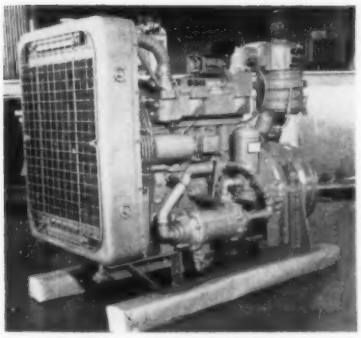
Three-Inch Diaphragm Pump

A wheel-mounted diaphragm pump with 3-in. hose connections has been added to the Midland Products Co. line of pumps. With a capacity of 4300 gph these pumps are suited for all types of utility and construction dewatering work. They handle sludges and solids that would normally clog centrifugal pumps. They can be wheeled about on a job or easily carried by two men. For information write to Midland Products Co., Midland Park, N. J., or circle **No. 8-17** on the reply card.

Overspeed Governor For Mounting on Tachometer Drive

A new body style is now available from Synchro-Start for mounting directly on a standard SAE tachometer take-off, thus eliminating the need for a flexible drive cable. Shank of the unit is 1⅛-in. hex with ⅞-18 internal threads for mounting. The tongue drive shaft floats so as to compensate for possible misalignment and is available in diameters of 0.187 or 0.152. This new body style is available for the complete line of speed sensitive switches which include overspeed, underspeed, two-switch and three-switch governors. For further details write Synchro-Start Products, Inc., 8151 N. Ridgeway Ave., Skokie, Ill., or circle **No. 8-18** on the reply card.

Unit shown in photo is essentially a single element speed sensitive switch



Shown is the D311 Caterpillar engine

Another New Engine Announced By Caterpillar

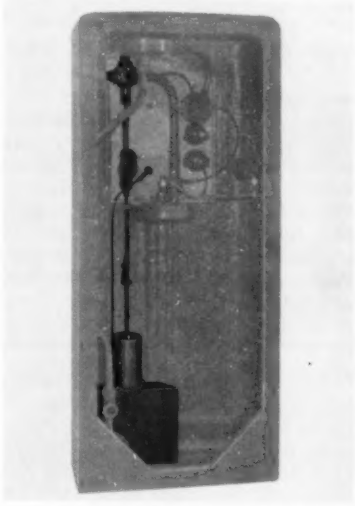
Another new diesel engine has been announced by Caterpillar. The 4-cylinder D311 (Series H) heavy-duty diesel engine has a 4-in. bore and a 5-in. stroke. It is a 4-cycle, naturally aspirated, valve-in-head model and employs the precombustion chamber type design used on all Caterpillar diesel engines. The 252 cu. in. displacement engine develops 75 hp at 2400 rpm. Other features of this unit include the harmonic Lanchester type balancers which provide six-cylinder smooth performance with a four-cylinder engine. A complete line of attachments will be provided including radiators, heat exchangers, clutches, torque converters, generators, marine gears, power take-offs and many others. For complete data write Caterpillar Tractor Co., Engine Div., Peoria, Ill., or circle **No. 8-19** on the reply card.

Self-Leveling Engineers' Level

A new self-leveling engineers' level has been introduced by Precision Instruments. Among the advantages of the new level are: 1) Actual working time may be reduced as much as 50 percent in extensive leveling operations; 2) many sources of errors such as creep of the spirit level bubble, are eliminated; 3) accidental changes in position of the level are automatically compensated; and 4) the need for delicate level vials is eliminated. The line of sight automatically assumes a truly horizontal position, once the instrument has been approximately leveled by its circular bubble. The self-leveling system consists of a pair of carefully positioned prisms which move automatically with any change of instrument setting and accomplish precise realignment of the line of sight, so that it intersects the center of the reticle at all times. The level is compact—overall height 5⅛ ins., telescope 7½ ins. long—and weighs with its tripod only 19¼ lbs. Write Precision Instruments Inc., 1900 Fifth Ave., Troy, N. Y., or circle **No. 8-20** on the reply card.

Pneumatic Positioner For Automatic Chlorinator Control

An effective new positioner that varies chlorinator feed rate automatically in proportion to a standard 3 to 15 psi pneumatic signal has just been announced by Wallace & Tiernan. The positioner is designed for use with V-notch chlorinators and this control device converts air-pressure signals from any standard pneumatic transmitter or air-pressure regulator to a mechanical movement. This movement positions the V-notch Variable-Orifice, thus varying chlorinator feed rate automatically. The positioner



Effective pneumatic V-notch positioner

provides a simple but effective way to achieve remote-manual, program, step-rate, or automatic-flow-proportional chlorinator control. Working parts of the positioner are contained in a corrosion-proof plastic case, air purged to prevent internal corrosion. Installation is simple: no change in the chlorinator itself is necessary. For information write to Wallace & Tiernan Inc., Belleville, N. J., or circle **No. 8-21** on the reply card.

Henry Backhoes and Loaders For Allis-Chalmers Tractors

The Henry Mark II backhoe and Henry L-600 utility loader are available for mounting on the Allis-Chalmers Model D-14 tractors. The backhoe digs to a depth of 12½ ft., has a loading height of 8½ ft., digs with 20 percent more power than former models at any angle within a 200° arc of swing, and has a reach from center line of rear axle of 18 ft. 8 ins. The loader has a dump height at maximum dump of 104 ins., a lifting capacity to full height of 1500 pounds, a breakaway capacity of 3000 pounds, and a digging depth below grade of 4 inches. For full details write the Henry Mfg. Co., Inc., Box 521, Topeka, Kans., or circle **No. 8-22.**

Lightweight Jackhamer

A new lightweight rock drill, called the J-30A Jackhamer, has been introduced by Ingersoll-Rand for applications where a powerful but easy to handle drill is needed. The drill is designed for construction and maintenance work. The J-30A multiple-use backhead design permits easy conversion from the standard blower style drill to the plain dry or wet styles. A new drill steel centralizer has all its working parts enclosed within the fronthead; this keeps out dust and dirt and virtually eliminates maintenance. For more information write Ingersoll-Rand, 11 Broadway, New York 4, N. Y., or circle **No. 8-23** on the reply card.

High Speed Photocopy

The Transcopy Meteor, made by Remington Rand, is a compact high speed photocopy unit, that exposes, develops and prints finished copies of originals up to 15 ins. wide and of any length in ½ minute or less. The Meteor is designed specifically for use under fluorescent or bright office lighting with the exclusive, built-in filter Safety Paper. It can be plugged into standard electrical outlets and no installation is necessary. It produces sharp, clear photocopies fast, economically, conveniently and accurately. The overall dimensions are: length 26½ ins., width 15½ ins., height 9¼ ins., and throat width 15 ins. More information from the Remington Rand Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y., or circle **No. 8-24** on the reply card.

Chipper Handles Limbs Up to 7 ins. in Diameter

Brush chipper eliminates excessive tree trimming time by handling 7-inch limbs

The Beaver brush chipper Model 160, announced by Mitts & Merrill, has a cutter opening of 10 ins. x 16 ins. and will handle branches and tree limbs up to 7 ins. in diameter, thus eliminating excessive trimming time. The 20-in. cylinder makes an overhanging flywheel or counterweight unnecessary and the entire mass of the rotating cylinder is in between the main bearings. The unique, staggered small knife system increases the efficiency and eliminates heavy shock and impact on the clutch, bearings and engine, and therefore reduces maintenance and operating costs. For more information write Mitts & Merrill, Saginaw, Mich., or circle **No. 8-26** on the reply card.

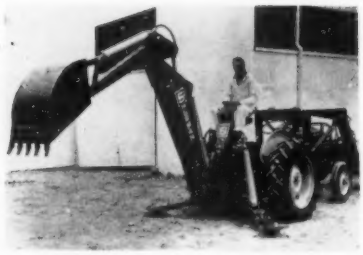
Compact Outdoor Vacuum Cleaner

A compact, portable outdoor vacuum cleaner has been introduced by Michigan Engineers. Powered by a 2¾-hp gasoline motor, the wheel-mounted cleaner called Tisit, may be used for picking up waste paper, leaves and all types of light trash. It is particularly adaptable for use in parking lots, parks, airports, ball parks, cemeteries and institutions of all kinds. The material picked up may be blown directly into inexpensive bags for disposal or it may be blown through an attached flexible tube for deposit into reusable bags, bins or refuse trucks. Shipping weight of the wheel mounted type, Y1, is 135 lbs., and the skid mounted Tisit, Y2, is 160 lbs. Accessories are also available: bags, flexible hose, clamps, adaptors and deflectors. More data from Michigan Production Engineering, 1796 E. 9 Mile Road, Hazel Park, Mich., or by circling **No. 8-27** on the reply card.

Tisit quickly cleans up litter in recreation spots, lawns and picnic areas

Fast-Digging Power Digger

A new, rugged, fast-digging, easily-detachable tractor-mounted digger called the Panther has been introduced by Sherman Products. The digger can be removed or attached in minutes permitting use of the tractor for other implements. It is powered by a 25 hp hydraulic system with a pump at the rear. All hoses connecting the working elements are rigidly clamped so that no scuffing can take place. It has a special transmission to step up power take-off shaft speed. The available digging force is 19,250 pounds. The Sherman mechanism for swinging the digger is unique in that the swing drive elements are kept in tension under all conditions even though the digger is swung down hill, thus eliminating slope which would be experienced if any wear had occurred. A flow control valve eliminates all chain slack and assures positive control in every digging position. More information from Sherman Products, Inc., Royal Oak, Mich., or circle **No. 8-28** on the reply card.

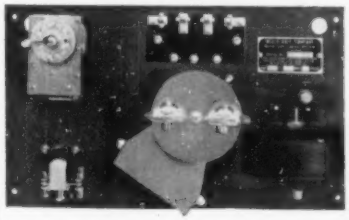


Sherman's new, fast-digging Panther

Bead Spreader For Paint Striping

The Mark-A-Zone bead spreader, announced by S. B. Beugler, automatically drops the beads evenly and immediately on top of the paint stripe. The spreader leaves no bare or uneven spots and the beads are imbedded on top of the paint stripe for full reflection. The stripe does not blacken with rubber marks because tires get traction on Mark-A-Zone laid bead stripes. The complete units are available in suitable widths for 3⅜ or 4-in. stripes and the 5-in. stripe. The bead spreader may be obtained as a separate unit and will attach to any Mark-A-Zone paint striper; the bead tank holds enough beads for 6 quarts of paint. It is used by municipalities and highway departments on parking lots and zones, pedestrian crosswalks, public buildings and streets. Write S. B. Beugler Co., 3667 Tracy St., Los Angeles 39, Calif., or circle **No. 8-29** on the reply card.

RPS ROTO-TROL



Pressure Operated Sump Control with Purged Air System

Furnished with compression bell for wet well. Pressure differential regulator with meter that regulates and indicates rate of air flow. Furnished with air compressor, or can be operated from plant air supply.

Write for New Bulletin RPS

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF Company

791 Hampden Ave., St. Paul 4, Minn.

The Heart of fine WATER PURIFICATION

SYSTEMS

Roberts Mechanical Equipment

ROBERTS FILTER Mfg. Co.

640 COLUMBIA AVE.
DARBY, PA.

NEWS OF ENGINEERS

EARL DEVENDORF, Director of the Bureau of Environmental Sanitation, N. Y. State Department of Health, has received the Herman M. Biggs award from the N. Y. State Public Health Association for outstanding service in the field of public health. Mr. Devendorf, who has long been recognized as a leader in public health engineering, has been with the New York State Dep't. of Health since 1918 and has been Director of the Bureau since 1948. He has been a leader also in the development of mutual aid for water departments in the state, as well as in water resources and water pollution control measures.

Mr. Devendorf

MICHAEL BAKER, Jr., consulting engineer, has received a Distinguished Alumnus Award from Pennsylvania State University. This award is made annually to former students of Penn State to recognize professional achievements and community service. Mr. Baker was graduated at the head of his class in 1936 with a civil engineering degree.

CALVIN G. BROWN has been appointed Director of Public Works for Mason City, Iowa. He was formerly City Engineer of Elgin, Ill.

DR. JAMES E. ETZEL formerly of E. I. Dupont de Nemours, has joined the staff of Roy F. Weston, Inc., Newtown Sq., Pa. He will work on research, development and process engineering.

DEWEY S. WRIGHT has resigned as City Engineer of Denver, Colo., to become an executive of the Elk River Concrete Products Co., Helena, Mont. He has served as Denver City Engineer since 1953. He will be succeeded in that post by C. E. HARNESS, presently Deputy City Engineer.

THOMAS R. GLENN, Jr., has been appointed Director and Chief Engineer of the Interstate Sanitation Commission (N. Y., N. J. and Conn.), succeeding SETH HESS who died recently. For the past two years, Mr. Glenn had served as Assistant Chief Engineer.

Dodson's Digest

Ladies (to the) Aid

Ralph Tully is a county road commissioner who uses Calcium Chloride extensively in the winter. But I had been unable to get him to even try it for dust-proofing during the summer. On the way to his office recently, I was surprised to find the roads virtually dust-free.

"How're things, Ralph?" I asked as I entered.

"Dandy, Dod!" he bubbled. "The weather's good. Equipment's holding up—and so am I! And I've started using Calcium Chloride for dust control, so I've no complaints."

"Well, this is one for the books!" I grinned. "I'd hate to guess how many times I've been in here trying to get you to use Calcium Chloride during the summer! Suddenly, between calls, you decide it's a good idea after all. At least all my efforts haven't been in vain!"

"That's for sure!" Ralph exclaimed. "I finally saw the light . . . and I'll never be without Calcium Chloride."

"By this time," I said, "you've no doubt proved that everything I told you was true. Keeps dust down. Hardens road surfaces for a better paving base. Eliminates chuckholes—all at less cost. And Calcium Chloride will last long—"

Just then Ralph's phone rang. While he was talking, I wandered out to his secretary's office. "Promise you won't say a word about this to Mr. Tully," she smiled.

"About what?" I asked.

She glanced over her shoulder. "Well, it may only be sheer coincidence, but the day he ordered his first load of Calcium Chloride was the day before his wife was having Ladies Aid, and gave him the old 'what for' about the dusty road running past their house!"

—L. D. Dodson

P.S.—Our folder, "How To Stop Bothersome Dust," will give you the full story on how Wyandotte Calcium Chloride helps *you* end your dust problems. Write me today for your free copy! *Wyandotte Chemicals Corp., Wyandotte, Mich. Offices in principal cities.*

Wyandotte CHEMICALS

WYANDOTTE CHEMICALS

MICHIGAN ALKALI DIVISION

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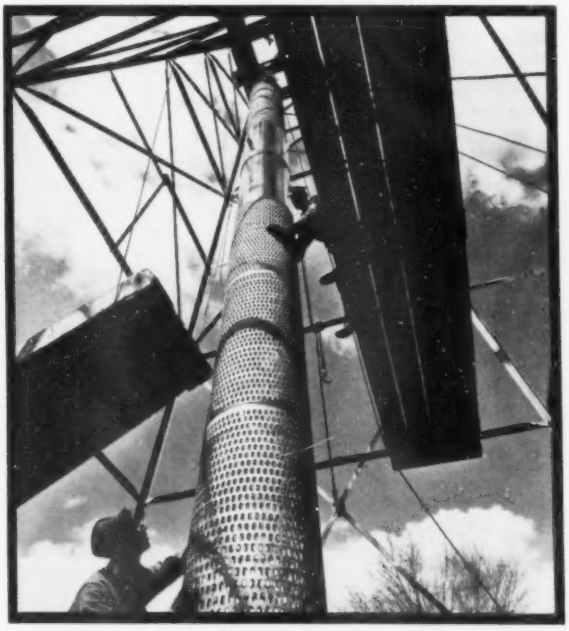
WORTH SEEING

A Mobil Sweeper Model 1000 has been purchased by Azusa, Calif. James Miller, City Administrator (left), Jim Brusnahan, Supt. of Public Works (seated in cab), and Bill Kirkgaard, City Engineer, are inspecting the sweeper. In Azusa all refuse swept from the streets is delivered direct to the dump by the street sweeper. Desirable factors, therefore, are fast sweeping and quick transport of loads to the dump.

Use of beam-type guardrail to define parking areas in municipal parking lots is illustrated by a Flex-Beam guardrail installation in White Plains, N. Y. Replacement of meter supports, often a maintenance problem, has been solved by the beam-type guardrail. Meters are placed behind the guardrail and drivers cannot back into the posts and damage them. Photo from Armco Drainage & Metal Products, Inc.

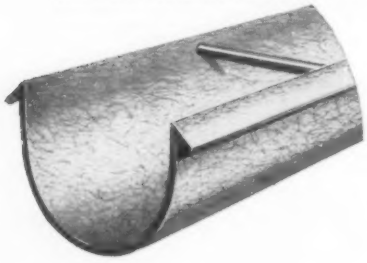
More than 31,000 feet of 1¼-inch to 3½-inch A. M. Byers Co. wrought iron pipe was used for compressed air line service in connection with sewage system lift stations installed in residential areas at Palm Beach, Fla. The installation was supervised by Norman C. Schmid & Associates, engineers for the town of Palm Beach. Malcolm Pirnie of New York and Clifford & Associates, now of Treasure Island, Fla., were consulting engineers for the project.



Screen being lowered into newly constructed well is made of type 304 stainless steel produced by Republic Steel Corp. To form the screen, Ohio Drilling Co. uses ¼-inch plates and punches slots ¾ inch wide and 1½ inches long; slotted plates are then welded into cylinders of desired size. It is claimed that the stainless steel screens do not rust and are not subject to encrustation. As many as 15 five-ft. lengths may be used in a single well.

Leopold

FIBERGLASS-REINFORCED PLASTIC WASH TROUGHS



- **Eliminate the costly maintenance jobs of chipping and painting!**
- **Easy to handle—inexpensive to install!**
- **Weather-resistant—will last indefinitely!**

With a background of more than '30 years' experience in wash trough design, Leopold has now developed a trough of Fiberglass-Reinforced Polyester-Laminate Plastic—a material that is structurally ideal for wash water troughs.

This new design offers a combination of advantages provided by no other type—uniform strength, dimensional stability, light weight for easy handling, complete resistance to weather and corrosion, built-in sand stop, mold-formed weir edges, and reinforced construction. In addition, Leopold Plastic Troughs, made from extra heavy fiberglass mat, are very durable—will last for years without any painting or other maintenance.

And of particular note—these unique troughs are available in a variety of cross-sectional dimensions, providing capacities to suit individual requirements.

Mail Coupon for Literature —Complete Details

F. B. Leopold Co., Inc.
Zelienople, Pa.

Please send literature on Leopold Fiberglass-Reinforced Plastic Wash Troughs.

Name_____

Address_____

City_____ Zone____ State_____

by Arthur K. Akers

★ UNION METAL MFG. CO., Canton, Ohio, (lighting standards) opens a Northwest district sales office in Portland, with G. W. Kolling as manager. E. B. Moss moves to Atlanta office, from Canton.

★ JOHN H. SNELLGROVE becomes assistant to the sales manager, Hersey Mfg. Co. (water meters), Dedham, Mass.

★ DOUGLAS FIR PLYWOOD ASSOCIATION, Tacoma, continues aggressive in the traffic sign field with addition of five men to its field promotion staff, located in New York, Washington and Minneapolis.

★ NATIONAL CLAY PIPE ASSOCIATION re-elects all officers for 1959, headed by President G. A. Robinson.

★ JOHN L. ROOT, chief, Ditcher Sales, Barber-Greene Co., Aurora, Ill., has been elected chairman of the newly organized CIMA Continuous Trenching Equipment Bureau.

★ DRAVO CORPORATION's Machinery Division appoints H. E. Lore manager of its Engineering and Construction Department.

★ RESPONSIBILITY for marketing Roots-Connersville Blower division of Dresser Industries, Connersville, Ind., now falls to W. "Win" Harris, formerly of General Electric Co.

★ J. A. FRANK moves up to president, National Water Main Cleaning Co., New York, as J. A. DeCamp becomes chairman of the board.

★ FRANK W. WALKER is named vice president and manager, Government Sales, by Motorola Communications and Electronics Inc., Chicago. In this field that's a long name for 2-way radio.

★ BORDEN METAL PRODUCTS CO., Elizabeth, N. J., spreads out—into a new plant in Conroe, Texas. Floor gratings will be the product.

★ DAVE PURDIE rounds out 47 years of service, largely as district manager of the New York office of B-I-F Industries, Providence, by retiring July 5. Dave has always claimed that he was a new employee, temporarily retained, but this retirement indicates that he was (as we always knew) a bona fide and valued member of the Builders team.

Mr. Purdie

Mr. Greenberg

★ BENNETT MFG. CO., Alden, N. Y., whose litter receptacles help "Keep America Clean," adds Milton W. Greenberg as national sales and advertising manager in an expansion program.

★ ALLIS-CHALMERS MFG. CO. announces: Charles W. Parker, Jr., promoted to director of sales promotion, a new position; A. R. Tofte is now manager Publications and Industrial Press Department; J. W. Murphy moves up to manager of the new Advertising Department.

★ JOHNS-MANVILLE began operating its new asbestos-cement pipe plant in Denison, Texas, June 20. Measurements are five buildings, 186,000 sq. feet of manufacturing and warehousing space.

★ CLEAVER-BROOKS CO., Milwaukee, announces John Nash appointed sales manager, boilers, which have many applications in the paving field.

★ THEN there was the high-dive artist who kept jumping from higher and higher into less and less water until he was diving 200 feet into a wet rag. His Waterloo came at 300 feet, however—some joker had wrung out the rag.

TELETAX* TELEMETERING

by Foxboro...

engineered for the most advanced transmission techniques

Telemetering matched in performance with famous Foxboro instruments — that's the Foxboro Teletax Telemetering System.

Through use of impulse-duration signals, Teletax electrically transmits measurements of a remotely-located variable to the central control station. Here, the Teletax receiver records the duration of impulse, which is directly proportional to the measured variable.

The Foxboro Teletax System is noted for its simplicity, its versatility, and its high sustained accuracy. For a transmission medium, it can use either AC or DC, an audio frequency carried on a transmission line, or radio or microwave impulses. Sustained accuracy is 0.5% of full scale.

TELETAX RECEIVERS

Teletax receivers include: Single or Dual Receivers; Multi-Record Receivers for recording up to 6 separate measurements on one chart; and Teletax Receiver-Controllers for automatic operation. And the Teletax signal can be simply converted to digital information.

TRANSMISSION LINK

With Foxboro's Teletax Telemetering System, you can use the most advanced transmitting techniques: two wire lines, power lines, radio or microwave. As many as 25 different signals can be handled in each direction, simultaneously.

TELETAX TRANSMITTER

The Teletax Transmitter houses either one or two standard Foxboro measuring elements — plus the Teletax transmitting mechanism. It will transmit to a control center hundreds of miles away just as easily as to one nearby. It also indicates or records locally if desired.

The Teletax Transmitter needs *no* periodic maintenance whatever, while the receiver requires only occasional oiling. And the receiver has a minimum of mechanical components to wear — no clutch to slip or jam.

Foxboro Teletax Systems are now in wide use on natural gas systems, water works, oil fields, power plants, steel mills, etc. Write for Bulletin 17-11C — it gives all the details. **The Foxboro Company, 268 Norfolk Street, Foxboro, Mass.**

*Reg. U. S. Pat. Off.

FOXBORO

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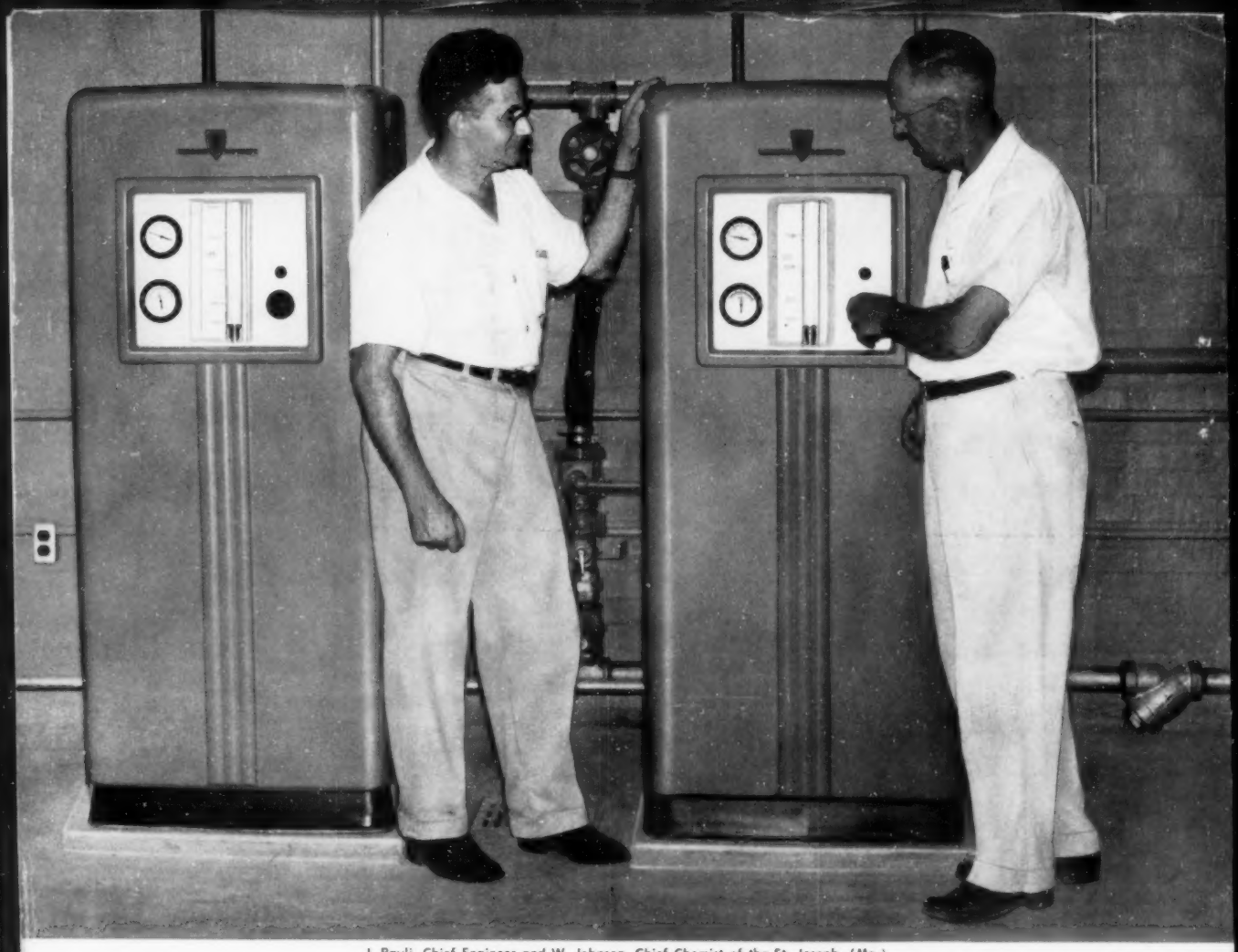
TELETAX TELEMETERING



J. Pauli, Chief Engineer and W. Johnson, Chief Chemist of the St. Joseph, (Mo.) Water Company, discuss operation of their W&T V-notch chlorinators. The St. Joseph Water Co. is part of the American Water Works Service Co., Inc. system.

W&T V-notch Chlorinators— doubly accepted

The St. Joseph Water Co. found breakpoint chlorination the best way to treat Missouri River water. But this increased the range of chlorine requirements in the water treatment. W&T V-notch chlorinators were the answer.

W&T V-notch chlorinators have a chlorine feed range of 20 to 1 with an accuracy of 4%. Based on this acceptance at its St. Joseph plant, the American Water Works Service Co., Inc. has purchased V-notch equipment for use in other plants.

V-notch chlorinators are available to feed from 2½ to 8000 pounds of chlorine per 24 hrs. V-notch equipment also provides permanence and attractiveness through modern reinforced plastics. For comprehensive information about W&T V-notch chlorinators, write for Bulletin S-119.78.

WALLACE & TIERNAN INCORPORATED

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